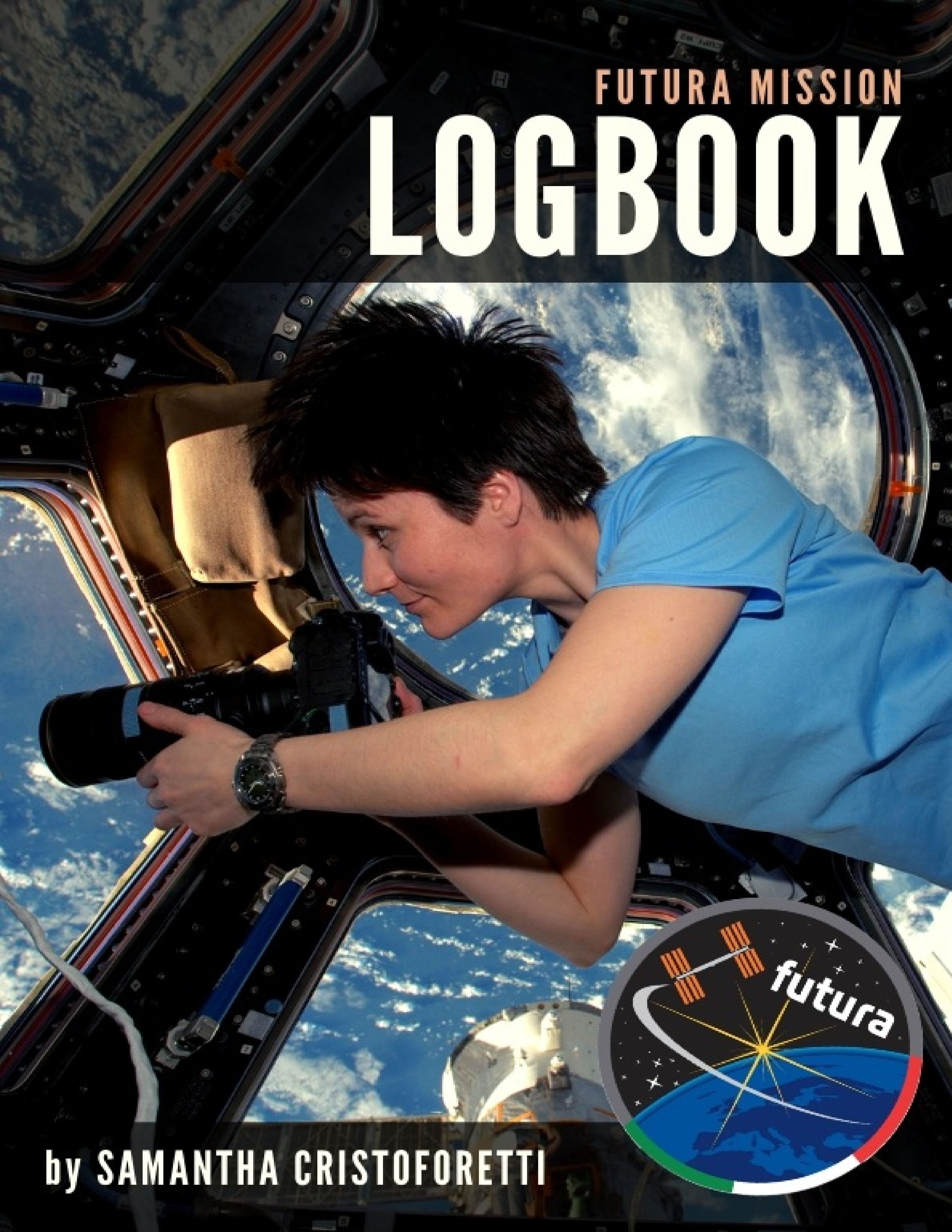
FUTURA MISSION

LOGBOOK



by SAMANTHA CRISTOFORETTI

Futura Mission Logbook

Samantha Cristoforetti

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Samantha Cristoforetti is a European Space Agency (ESA) astronaut of Italian nationality. Between November 2014 and June 2015 she spent 199 days on board the International Space Station as a Flight Engineer for Expedition 42 and 43. During ASI's Futura Mission, Samantha conducted experiments in the Station's laboratories. Samantha is a Captain in the Italian Air Force.

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Futura Mission Logbook

ESA astronaut Samantha Cristoforetti documented in this Logbook the last 500 days of her training for her first space mission and her 200 days on the International Space Station as crewmember of Expedition 42/43, also known as Futura Mission. She arrived on ISS on November 24, 2014, six hours after being launched from the Baikonur cosmodrome in Kazakhstan onboard of the Soyuz TMA-15M spacecraft, together with Russian cosmonaut Anton Shkaplerov and NASA astronaut Terry Virts.

Sources and translations available

Futura mission website (Italian): Avamposto42

(Trad IT) Traduzione in italiano a cura di +AstronautiNEWS:
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L-500: Logbook

Astronauts Samantha Cristoforetti and Anton Shkaplerov in the Soyuz simulator in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.07.19—It's L-500 days! Not that I'm counting of course :-)

Launch date might always change a little bit, but one needs to have a target in mind, so I thought I'd start the countdown and also start a little logbook on what's going on in my training days.

Thanks to Michael Sacchi for indirectly giving me the idea!

I'm in Star City! In a few minutes I'll ride my bike to the training facilities. Today, I'll have four hours of Soyuz sim with my Commander, Anton. It will look somewhat like in the picture. But before the sim itself, this morning we'll have a two-hour brief with our instructor, Dima, discussing what awaits us in the afternoon.

Yesterday we went over a nominal reentry… which of course turned off-nominal when both the main computer and the engine failed on us.

Today we'll do the emergency descent scenario… that's when something is really wrong and you need to get down quickly!

Italian translation of this logbook entry: L-500! Inizia il diario di bordo di Samantha Cristoforetti della sua prima missione spaziale, by Paolo Amoroso—AstronautiNEWS.

L-499

Samantha Cristoforetti's Soyuz manuals on the ESA office table in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.07.20—No training is usually scheduled on the weekend. Time to rest, of course, but also an occasion to workout with no rush and to catch up.

Star City in summer is a great place to go running or biking outside, since we're pretty much surrounded by trees and little lakes. But for the moment the day is quite cold and humid. I'll see if it gets better in the afternoon and in the meantime I'll work to reorganize my notes from this week's sims on the Soyuz procedure books (in the pic).

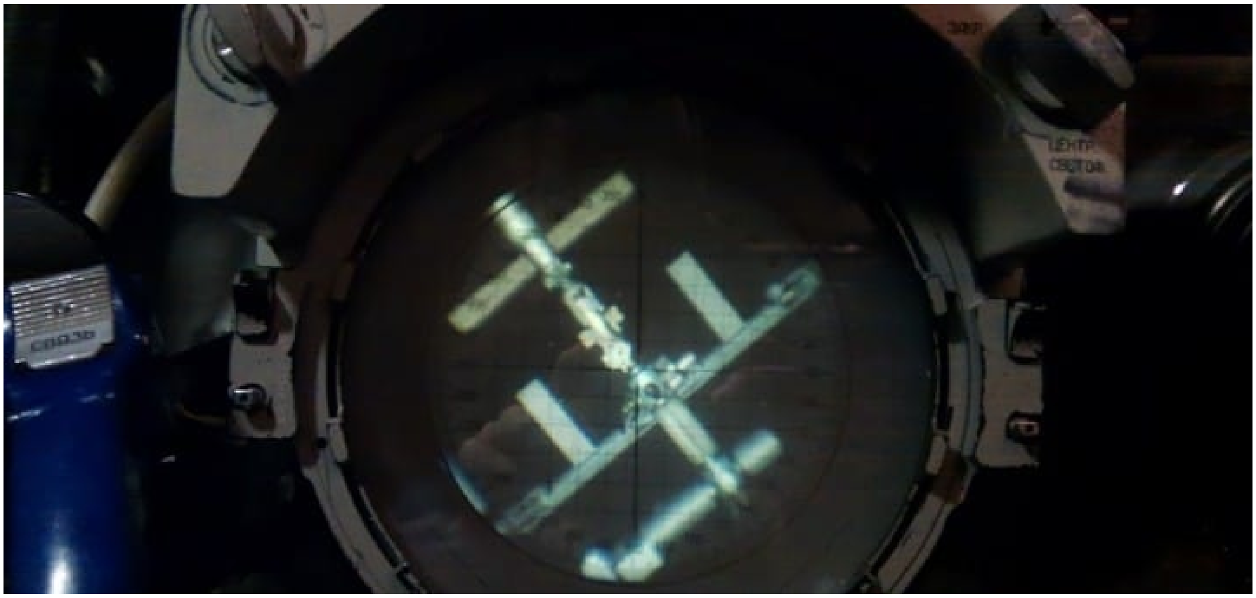
As we go through the Soyuz sims, we all add notes and reminders and we try to highlight actions that are especially important and/or easy to miss.

I'm the only ESA astronaut here this month, so I have hijacked the big table in the ESA office. The bulk of the Soyuz training we do is on the reentry book. In the end, coming back safely from space comes down to one thing: whatever happens, do whatever it takes to give the necessary braking burn. That means: at the right time, with the proper orientation and with the required impulse.

If you don't do that, who knows when and where you're going to land!

Italian translation of this logbook entry: L-499: Per rientrare accendi il motore, a qualunque costo, by Paolo Amoroso—AstronautiNEWS.

L-498



The ISS seen in the Soyuz perioscope in the simulator. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.07.21—Another rainy and chilly weekend day in Star City. I guess I'll work out in the gym again today, instead of running outside.

On the training side, I'll review my notes from the class on the 4-orbit rendezvous profile. Believe it or not, I recently had to go back to classroom for a theory lesson!

As you might have heard, the trip to the ISS has become a lot shorter lately. Starting with the crew of Pavel Vinogradov this past spring, we've been experimenting with the "quick rendezvous" which brings the Soyuz to docking within about six hours (or four orbits) from launch.

It used to take two days to get to Station. After ascent and insertion into orbit, the ground personnel would track the Soyuz, measure its actual position and velocity and, based on that, calculate and upload to the onboard computer the data for the engine burns: when should the engine turn on? for how long? in what orientation should the capsule be? The goal of course is to get closer to the ISS and into a position from which the onboard computer can calculate the final rendezvous burns.

Now, it turns out that after hundreds of Soyuz and Progress launches Russian controllers have a lot of statistical data and can predict pretty well how the orbit will look like after launch. So we now insert the data for the first two burns when the rocket is still on the launchpad and get those first two burns done right away.

It means that after launch things will go pretty fast! As the board engineer, I will devote my attention mainly to the systems verification and to the leak checks, making sure we're not losing air into free space. In the meantime Anton will monitor the beginning of the dynamic mode: in preparation of the engine burns, the Soyuz will orient itself along the local vertical (with the "belly" pointing to Earth) and he will be able to observe this procedure in his periscope view. Like in the picture, except that at this point Anton will see the Earth, not yet the Station.

Of course, as a good crew we'll try to look each other over the shoulder as we work in parallel to make sure we don't miss anything and we're well on our way to humanity's outpost in space!

Italian translation of this logbook entry: L-498: Rendezvous veloce per principianti, by Paolo Amoroso—AstronautiNEWS.

L-497

The Soyuz TMA-7 leaves the ISS. Source: NASA

Star City (Moscow, Russia), 2013.07.22—Starting one more week of training here in Star City.

I won't be in the Soyuz sim today, but I'll have a two hour briefing with my Commander Anton and our instructor Dima. The actual sim will be tomorrow morning and will probably be a "suited" one, meaning that we'll wear our Sokol pressure suits.

In the afternoon I'll have a training session in manual re-entry. The Soyuz re-entry is normally controlled automatically by an onboard computer. However, there are some failure modes in which the computer won't do it, either because it's broken or because it doesn't like the entry conditions into the atmosphere. In these special cases, before going for a ballistic re-entry, the crew can actually try and "save" the controlled re-entry mode by taking over manually.

At that point, separation has already occurred and only the descent module remains. If you take a look at the picture, that's the bell-shaped central part. The spherical orbital module and the cylindrical service module burn up on their own during re-entry.

Controls are pretty easy - as they should be, since you'll be under G and wearing the thick gloves of the pressure suit. However, ending up close to the nominal landing point while keeping the G loading within required limits… not easy at all. Well, that's why we practice!

Italian translation of this logbook entry: L-497: Controllare il rientro della Soyuz schiacciati dall'accelerazione, by Paolo Amoroso—AstronautiNEWS.

L-496

"Samantha Cristoforetti, Anton Shkaplerov and Terry Virts in front of a Soyuz simulator in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.07.23—I will spend six hours in the Soyuz simulator today! Actually in two different ones.

The first one you can see in the picture. That day our crewmate Terry was with us as well, now he's in the US. It's in this type of sim that we practice all phases of flight. The hatch right behind us, btw, does not exist in the real spaceship: on the launchpad you have to lower yourself down from the top section, the orbital module. But for the daily work it would be a bit cumbersome.

We also have another sim type that is used only to train manual rendezvous, manual docking, undocking-and-redocking to another port (this latter is always manual). I'll have a practice session in the afternoon.

In the morning I'll be with Anton in the sim to practice ascent and post-ascent orbital operations. We'll start out, as we would nominally, with the quick rendezvous procedures that I've talked about a couple of days ago.

But in the process of doing the burns to get to Station, something will happen that will make it impossible to keep the tight schedule.

Fortunately, the "old" two-day rendezvous profile always applies! In agreement with the ground, we'll transition to the longer profile and give ourselves some more time to fix the issues. We'll just have to wait a bit longer for that warm meal!

Italian translation of this logbook entry: L-496: Che fare se non si può arrivare alla ISS velocemente?, by Paolo Amoroso—AstronautiNEWS.

L-495

Samantha Cristoforetti is prepared for a session in the Star City centrifuge. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2013.07.24—Today I go ballistic!

The Cosmonaut Training Center here in Star City is the home of the world's biggest centrifuge with its 18-meters arm. It's a pretty impressive beast. I had a first ride in it last week (foto) and I've written about it here.

But while last week I only went to 4.3 G, this time I will experience up to 8G. The purpose of this is not to inflict unnecessary pain on poor crewmembers, but rather to prepare us for the case of a ballistic reentry, when G loads can easily go up to 8G and more!

So, what's a ballistic re-entry? That's a mode in which nobody, neither the crew nor the computer, is trying to control the re-entry trajectory of the vehicle. It pretty much comes down like an inert body with a trajectory dictated purely by its geometric characteristics and mass distribution. With one trick: the capsule is put into a continuous rotation around it's longitudinal axis of about 13°/sec.

So, why would we choose to go ballistic? Not that the nominal re-entry is a smooth ride, but this one is definitely rougher. Well, it could happen because of a number of failures during the nominal reentry. That's why whenever a crew is returning from orbit there are always two rescue teams waiting: one at the nominal landing site and the other at the ballistic site.

But it could also happen that you have to leave the orbit quickly because of an emergency, for example a fire or a depressurization. In that case the control teams at Mission Control Moscow don't have the time to calculate and upload into the onboad computer the data for a controlled re-entry. So ballistic it is! And no, there won't be a rescue team waiting in this case.

Italian translation of this logbook entry: L-495: Nella centrifuga più grande del mondo, by Paolo Amoroso—AstronautiNEWS.

L-494

Terry Virts, Anton Shkaplerov and Samantha Cristoforetti in front of a Soyuz simulator in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.07.25—Last day of training in Star City for this trip and it will be another full day in the Soyuz simulators!

First a manual approach session, in which Anton gets to practice getting the Soyuz manually from a distance of a few km to about 100 meters in front of the docking port. As the flight engineer, I'll help him out from the orbital module by measuring speed and distance with a laser range finder.

Then it will be my turn at the controls. I'll have a solo session on manual docking, when I'll practice docking the Soyuz from within 400 meters - that's what we call the close-range.

The afternoon will be… hot! At some point during our training session in the Soyuz simulator smoke will start flowing into the descent module from behind the control panels. Not that smoke would necessarily have to flow from that direction in real life, but the simulator does have some known patterns of behavior of course. We'll turn off all electric equipment but I have a distinct feeling that, like every time, this will not fix the problem in our scenario. So we'll be left with only one choice: removing all the atmosphere. That will definitely kill the fire!

Once everybody has donned their Sokol pressure suits and the suits have passed the leak check, we will depressurize the capsule and start working procedures to organize the emergency descent. At this point, we're on a clock: the suits are connected to the oxygen tanks and they can keep us alive for a couple of hours. That's plenty of time to organize the braking burn that will bring us back into the atmosphere, but there is certainly no margin for not getting it right the first time!

Italian translation of this logbook entry: L-494: E se c'è un incendio a bordo?, by Paolo Amoroso—AstronautiNEWS.

L-493

Samantha Cristoforetti in a Soyuz simulator in Star City. Source: Samantha Cristoforetti

Frankfurt (Germany), 2013.07.26—D-Day has arrived.

Departure Day, that is. Definitely not my favorite part of training life: when you have to pack your bags and move to the next location. In Star City I have an accommodation that is assigned to me, meaning that I always stay in Room 32 when I come for training. But while I'm gone, other ESA personnel on business travel can stay there, so when I leave I need to pack all my stuff and put in storage whatever I don't want to take with me. It feels a bit like putting one life on freeze as I go somewhere else to live another life for a while.

Because traffic around Moscow is typically inclement, we usually leave Star City 4 to 5 hours before plane departure. That can be even earlier on snowy days, a bit later if we leave at low-traffic times, like today. Our skillful driver, Nikolay, knocked at my door at 5 am this morning.

Now I'm in Frankfurt waiting for my train to Cologne. I have some office work to take care of at the European Astronaut Centre this afternoon. Sitting here in the busy terminal, it's strange to think that I was riding my bike in peaceful Star City just last night. Or, for that matter, around this time yesterday I was settling in my chair in my "other" office. I attached a picture.

Lots of lessons learned from our fire sim yesterday, especially in terms of distributing tasks between Anton and myself during a fire case. When the situation is critical, Crew Resource Management is especially important!

Italian translation of this logbook entry: L-493: È arrivato il giorno della partenza da Mosca!, by Paolo Amoroso—AstronautiNEWS.

L-492

Before the 8G centrifuge run. Getting final instructions from the doctor supervising the exercise. Source: Gagarin Cosmonaut Training Center

Cologne (Germany), 2013.07.27—Enjoying a day off at home!

Lots of little things to take care of before I depart for Houston early tomorrow, but all in all a relaxing day.

I thought I'd share some pictures from the 8G centrifuge run earlier this week. Some of you asked to see some "after" pictures, so here you go: before, during and after!

I'll tell you more tomorrow about how it felt.

At the 8G plateau from the doctor's camera view.

After the run, as centrifuge operators are sliding the seat out of the centrifuge.

Italian translation of this logbook entry: [L-492: Prima, durante e dopo la centrifuga a 8G](), by Paolo Amoroso—AstronautiNEWS.

L-491

The A380 for Houston waiting at Frankfurt airport where Samantha Cristoforetti is going to embark on 2013.07.28. Source: Samantha Cristoforetti

Frankfurt (Germany), 2013.07.28—I'm on my way to Johnson Space Center for four weeks of US training.

Short train ride from Cologne to the Frankfurt airport early this morning and now an 11-hour flight to Houston. There's an A380 waiting at the gate, boarding is about to start. As you can see in the picture, boarding for this "beast" is done via three jetways on multiple levels!

I'm not looking forward to the 7-hour difference in time zone. Actually 9 hours compared to Star City, where I was just two days ago. Jet lag might be the single greatest hurdle in astronaut training for me: it always takes me a week to ten days to get back to normal sleeping patterns after a intercontinental flight. Maybe because I'm accustomed to be a sound sleeper and typically fall asleep within seconds of hitting the pillow, dealing with sleep disruptions is not my cup of tea.

Anyway, I see it as part of the training. Sleep shifting occurs pretty often on the International Space Station, in particular when the crew needs to support the arrival of new crewmates or of resupply vehicles like Progress, ATV, HTV, Dragon or, in the new future, Cygnus. As you can well imagine, docking times are determined by orbital mechanics, launch windows and orbital day/night requirements, not by the sleep schedule of the crew.

I'm experimenting with a more deliberate approach to sleep-shifting. I'm wearing sunglasses this morning to reduce light exposure while it's night in Houston. And I've purposely slept only a couple of hours last night, in the hope that this will help me be asleep most of the flight to the US. In a couple of weeks I'll have a briefing at Johnson Space Center on sleep shifting techniques: looking forward to learning some helpful tricks!

Italian translation of this logbook entry: L-491: Spostamento del sonno, jet lag e grandi aerei, by Paolo Amoroso—AstronautiNEWS.

L-490

The view from Samantha Cristoforetti's office at NASA's Johnson Space Center in Houston. The building at the bottom right is the Mission Control Center - Houston. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.07.29—Just had a tag-up with my NASA ITI (Increment Training Integrator) Alicia on the upcoming four weeks of training. Terry and I will be busy!

Now I still have half an hour to take care of some admin stuff at my desk. It's a gorgeous view from the window, as you can see. The building far on the right, by the way, is Mission Control Center - Houston. For friends MCC-H. More formally: the Gene Kranz Mission Control Center. Remember "failure is not an option"?

Soon I'll be heading to a class on Fluid Quick Disconnects (QDs) operations. QDs connect different segments of the fluid lines outside Station, in particular the highly toxic ammonia lines. I've worked with QDs in the pool before during EVA training, but the pool mockups are low-fidelity. Today we'll spend some time working with the high-fidelity QDs.

In the afternoon I'll have a class called retinal imaging, in which I will be taught some skills necessary to perform examination of another crew-member's eyes. Better learn this well!

Italian translation of this logbook entry: L-490: Quick Disconnects, esame della retina e panorama, by Paolo Amoroso—AstronautiNEWS.

L-489

Samantha Cristoforetti practices with an ophthalmoscope at the JSC. Source: Samantha Cristoforetti

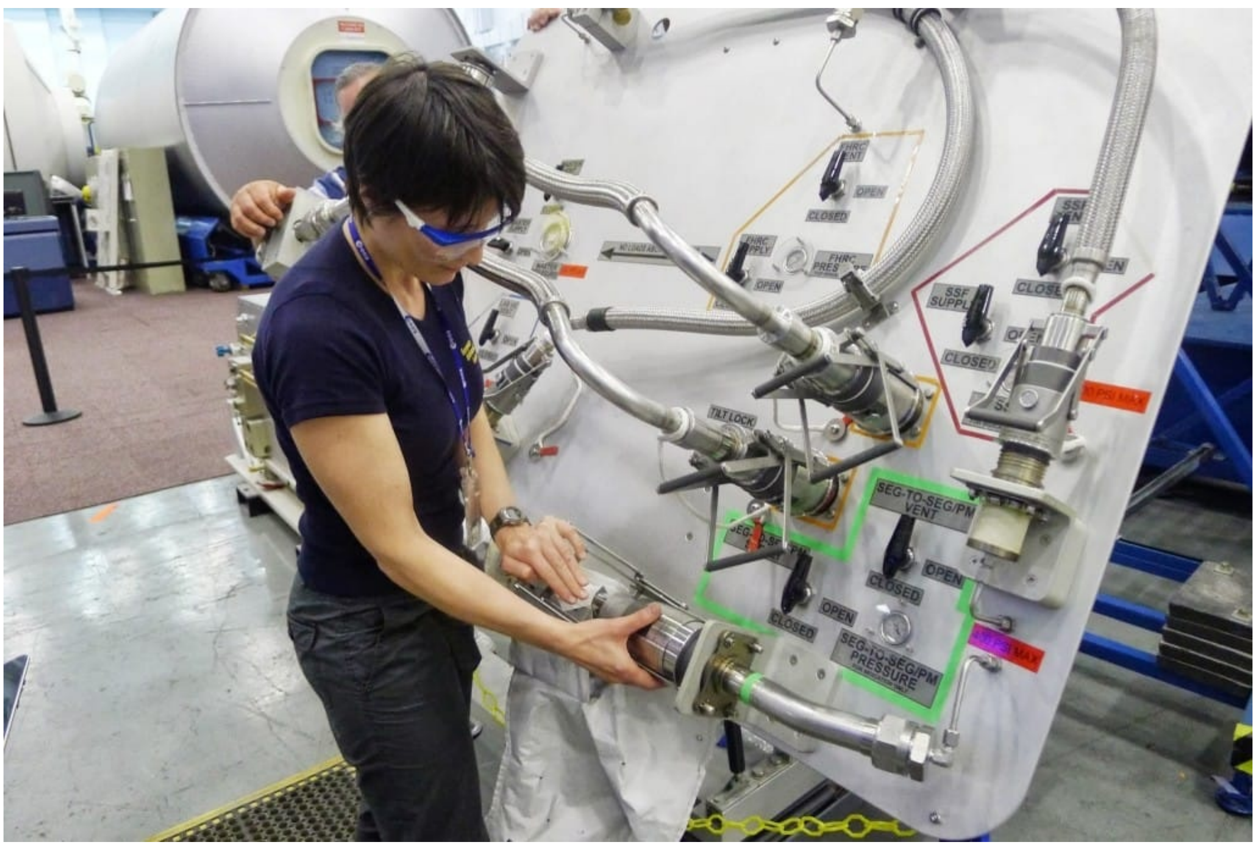
Johnson Space Center (Houston, USA), 2013.07.30—I'd say today is a day devoted to overall well-being on ISS.

Both Terry and I are being trained as Crew Medical Officers (CMO). We've both already taken a number of classes covering basic medical procedures. For example, the retinal imaging class I had yesterday! You can see me in the picture getting a feel for the fundoscope that is used to take images of the retina. As you might have heard, many long duration crew-members have experienced eyesight degradation during their mission and the reasons are not fully understood yet. That's why we're now monitoring the eyes so closely throughout the spaceflight.

As CMOs, today Terry and I we'll have a brief on the main psychological disorders that might occur in long duration spaceflight: how to recognize them, what to do about them. If you ask me, good food is one of the main means of psychological well-being. How fitting that today we'll also have our ESA food tasting! ESA does not provide food for the standard ISS menu, but we do provide a number of dishes that crew-members can choose for their bonus food containers.

Another aspect of well-being is overall fitness. Today I will also have a training session on the ARED (Advanced Resistive Exercise Device). The ARED is the weight-lifting machine onboard ISS, except that it doesn't have weights, but rather big vacuum cylinders that provide resistance as we do squats, chest presses, bicep curls and much more.

I've also attached a picture from [the Quick Disconnects class](#) I talked about yesterday, in case you're curious to know how QDs look like. We got to practice on pressurized QDs on a special pressure trainer. Having to deal with the pressure in the lines gave me a whole new respect for this task!



Working on a 1.5 inch Quick Disconnect on the pressure trainer. Source: Samantha Cristoforetti

Italian translation of this logbook entry: [L-489: Com'è un oftalmoscopio?](#)

E un Quick Disconnect?, by Paolo Amoroso—AstronautiNEWS.

L-488

Astronaut Alexander Gerst trains in the rendezvous and berthing in the Dome simulator at the JSC. Source: Alexander Gerst / NASA

Johnson Space Center (Houston, USA), 2013.07.31—The training day will start in a couple of hours with a short lesson on the still camera that is taken out on spacewalks and with which EVA crew-members have taken stunning photos outside Station.

Then I'll move on to a two-hour refresher on Crew Medical Officer skills. These classes have pretty serious currency requirements, as you can imagine. On the plan, among other things, a review of catheterization procedures, just in case microgravity messes up with somebody's bladder functions. I know, not a very glamorous part of spaceflight, but a situation we want to be ready for!

In the afternoon Terry and I will have a a three-hour free flier rendezvous class in the dome. Free fliers are visiting vehicles like HTV, Dragon or, in the near future, Cygnus, that don't come all the way to docking, but rather hold position at 10 m from Station and are then grappled by the astronauts with the robotic arm and berthed to a free ISS port.

I've found a really cool picture of fellow Shenanigan Alex in the dome. It's a pretty amazing facility in which we practice the rendezvous phase of vehicles from corridor monitoring during the approach phase all the way to grappling with the Canadarm2.

Final event for the day, a fit-check for my custom-made earplugs. Those are especially important for the periodic hearing assessment on ISS, in which we monitor the hearing function of astronauts throughout the mission. With all those pumps and fans running all the time, ISS is never very quiet!

Italian translation of this logbook entry: L-488: Volo libero e procedure mediche che speriamo di non usare, by Paolo Amoroso—AstronautiNEWS.

L-487

Samantha Cristoforetti practices the Canadarm 2 in the Cupola simulator. Source: Josh Matthew

Johnson Space Center (Houston, USA), 2013.08.01—Today I go 3D! Day will start with a class on the ISS 3D camcoder. I have no experience at all with such equipment, so I'm very much looking forward to it.

The Canadarm 2 approaches Cygnus in the Dome simulator. Source: Josh Matthew

Then I will have an EVR refresher class. The acronym EVR refers to robotics operations in support of EVA activities: that's when we " fly" spacewalkers around Station on the the Canadarm2. This refresher is important, because tomorrow I will get operate the NBL robotic arm for the first time. Yes, there is actually a robotic arm in the pool!

Just to keep my head in the Crew Medical Officer world as well, I'll have a class later today on dental procedures that could be required onboard ISS.

I attach some pictures from our training in the Dome yesterday, where we got to practice our teamwork in monitoring the approach of Cygnus. We're all very excited about the first Cygnus flying to ISS next month!

Practice with the Canadarm 2 in the Cupola simulator. Source: Josh Matthew

Italian translation of this logbook entry: [L-487: Catturare Cygnus](), by Paolo Amoroso—AstronautiNEWS.

L-486

The Canadarm 2 robotic arm in the NBL of the JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.08.02—Really busy day today. Mostly at the Neutral Buoyancy Facility (NBL), the giant pool where we practice spacewalks.

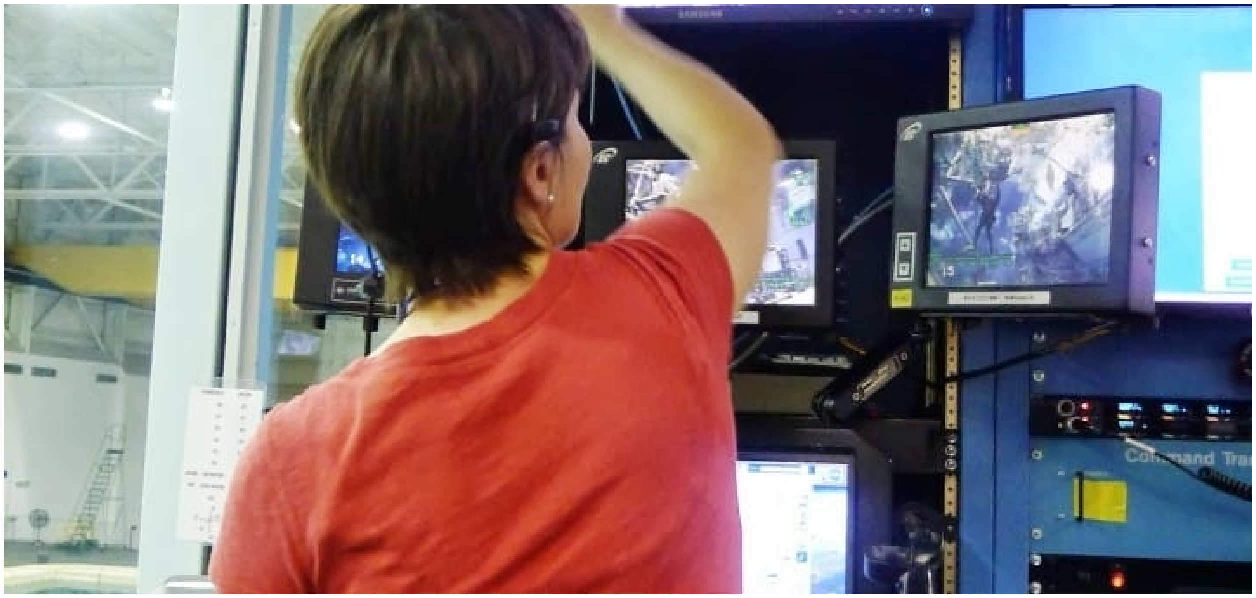
I helped suit-up crew-mate Butch early in the morning and then I operated the robotic arm in the pool for several hours. You can see parts of the arm sticking out of the water in the pic.

Then Terry and I had a three hour class in which we pretty much took a spacewalking suit apart and put it back together.

I'll share more pics over the weekend!

Italian translation of this logbook entry: L-486: Operazioni robotiche nella grande piscina, by Paolo Amoroso—AstronautiNEWS.

L-485



Samantha Cristoforetti at the command of Canadarm 2 of the NBL at the JSC. Source: Samantha Cristoforetti

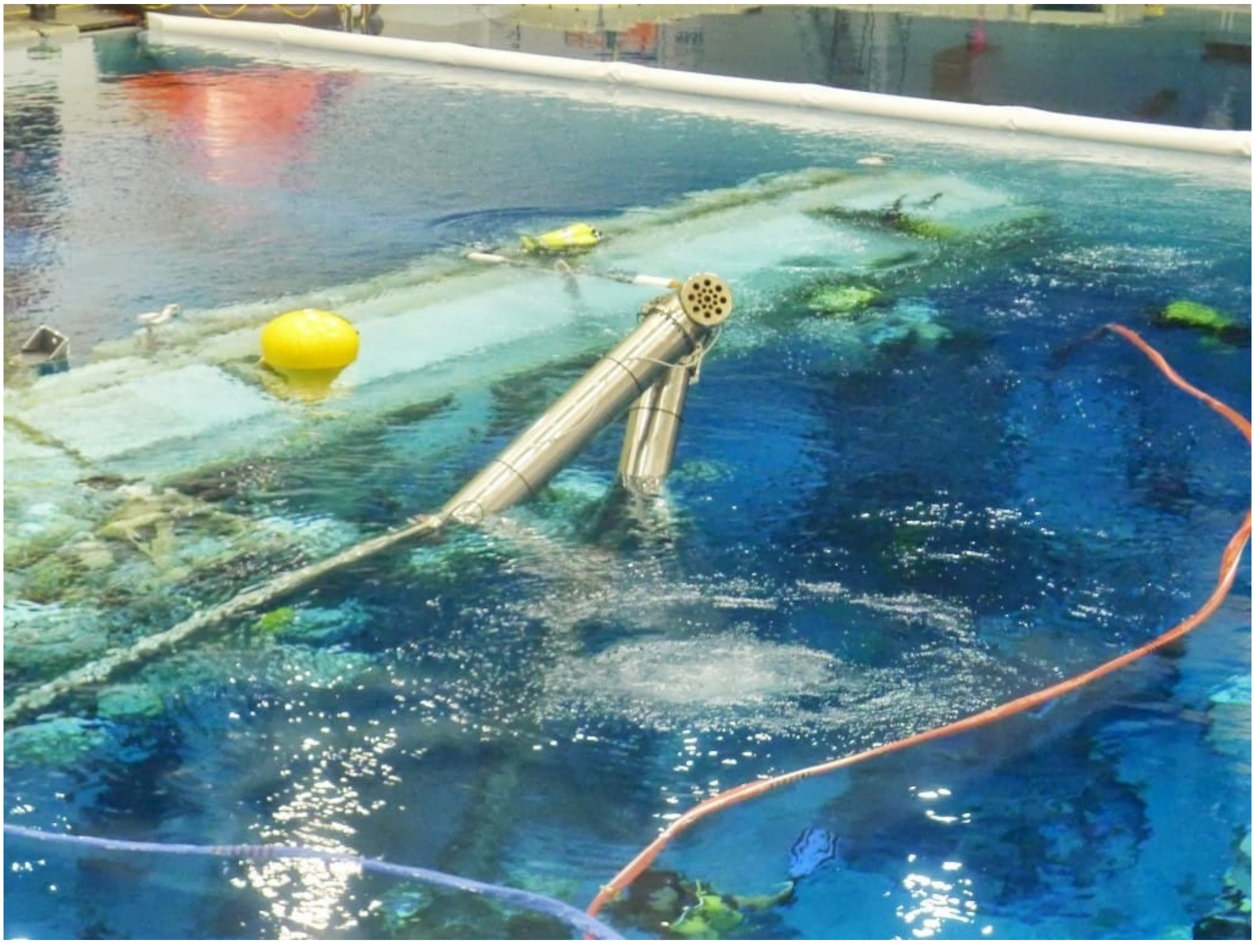
Johnson Space Center (Houston, USA), 2013.08.03—No training scheduled on the weekend, although I will certainly take some time to review my notes of the week and to start preparing for next week's training in the NBL, the big pool where we practice spacewalks. Terry and I will train for a contingency replacement of a pump module. Sounds familiar? That's because it has already happened on orbit!

Helping to wear an EVA suit. Source: Samantha Cristoforetti

I've attached some pictures from yesterday at the NBL. I showed up early in the morning for a brief on the peculiarities of the pool's robotic arm. The software interface and the hand controllers are the same, but the arm itself is of course quite different and the pool has its own special constraints. If you ever hear me say on orbit: "I can't go any further nadir, we're getting close to the floor"… something is badly wrong!

Flying the arm in the pool is mainly focused on the GCA moments. That's an acronym we borrowed front the aviation world and it stands for Ground Controlled Approach. A GCA controller has the approaching aircraft on the radar and gives instructions to the pilot to keep the plane on the glide-path until the pilot has the runway in sight. In the EVA world, a GCA is when the spacewalking crew-member gives instructions to the robotic arm operator in order to move the arm to a particular position. Instructions can be for example "1 meter station zenith" or "15° body pitch up". Since GCAs usually occur close to structure, good situational awareness on the part of everybody involved is very important and effective communication is vital.

I also got to practice suiting up crew-mate Butch. That's not an easy task. We usually have very skilled suit technicians who help us, but on orbit we'll be on our own, so it's important to be able to help each other getting into the suit.



The robotic arm in the NBL pool. Source: Samantha Cristoforetti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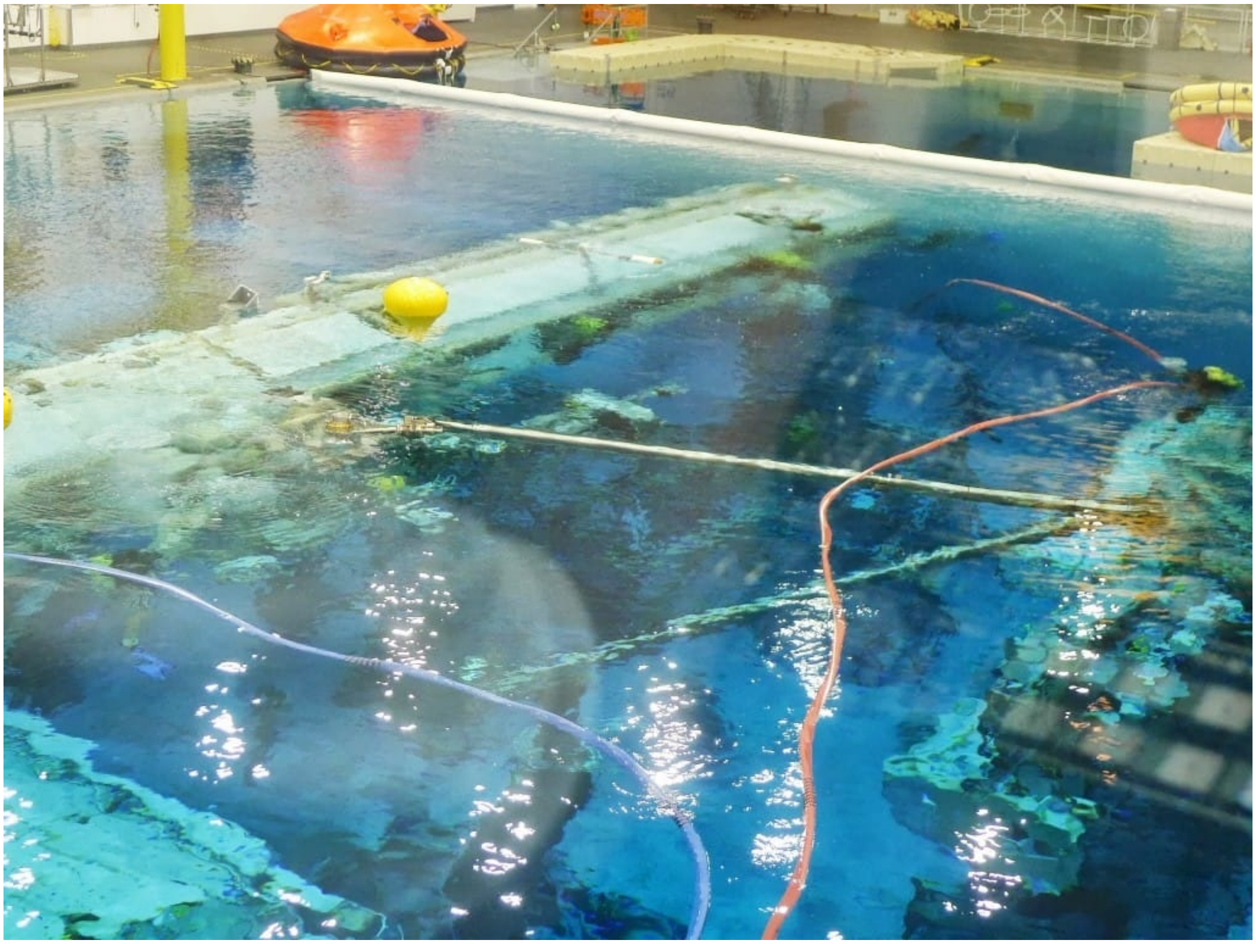
Helping to wear an EVA suit. Source: Samantha Cristoforetti

At the controls of the robotic arm in the pool of the NBL. Source: Samantha Cristoforetti



The robotic arm in the NBL pool. Source: Samantha Cristoforetti

Italian translation of this logbook entry: [L-485: Pilotare il braccio robotico](), by Paolo Amoroso—AstronautiNEWS.

L-484

Samantha Cristoforetti performs some dental procedures. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.08.04—Sharing some pictures from training events this past week today.

You might remember I had a class on the EVA camera this week. It's actually a commercial off-the-shelf camera with minor modifications, like the use of a lubricant that is suitable for vacuum operations. There are many such cameras on ISS and crew-members use them to take pictures inside all the time. When a camera needs to go outside, it's nicely wrapped in a white garment, as you can see in the picture. That's mostly done for thermal balance purposes.

A camera with EVA thermal coating. Source: Samantha Cristoforetti

I also had a [class on the 3D camcorder](). Now, that really opened a new world to me. Convergence, negative parallax, positive parallax… there's a whole new complexity compared to shooting 2D video!

Shooting training with the 3D video camera. Source: Samantha Cristoforetti

As for the dental procedures class, don't worry: nobody plans to have us do major dental work while on orbit. Main things I have been shown is how to temporarily fill up a hole in the tooth if a filling has come off and how to reattach a crown. Also, I had some instructions in how to give a local anesthesia as a temporary relief in case of a bad tooth ache.

Dismantling an EMU suit. Source: Samantha Cristoforetti

Finally, a picture of our class taking apart the spacewalking suit. Its real name is Extravehicular Mobility Unit (EMU), but everybody calls it simply "the suit". That was a fun class!

Italian translation of this logbook entry: L-484: Foto-video camere, procedure dentistiche, EMU, by Paolo Amoroso—AstronautiNEWS.

L-483

Expedition 34 members train for CPR (cardiopulmonary resuscitation) on the ISS. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.05—Starting the week with some serious emergency scenarios!

I'm not talking about fire, leaks or toxic spills, but rather medical emergencies. Whether we are designated Crew Medical Officers or not, we are all trained in responding in case a crew-mate has no pulse and/or is unable to breath. We have a permanently deployed Crew Medical Restraint System with which we can keep someone in a stable position to administer CPR (Cardio Pulmonary Resuscitation). I attached a couple of pictures from Expedition 34 in which you can see that crew-members have different options in weightlessness when it comes to body positions to administer compression.

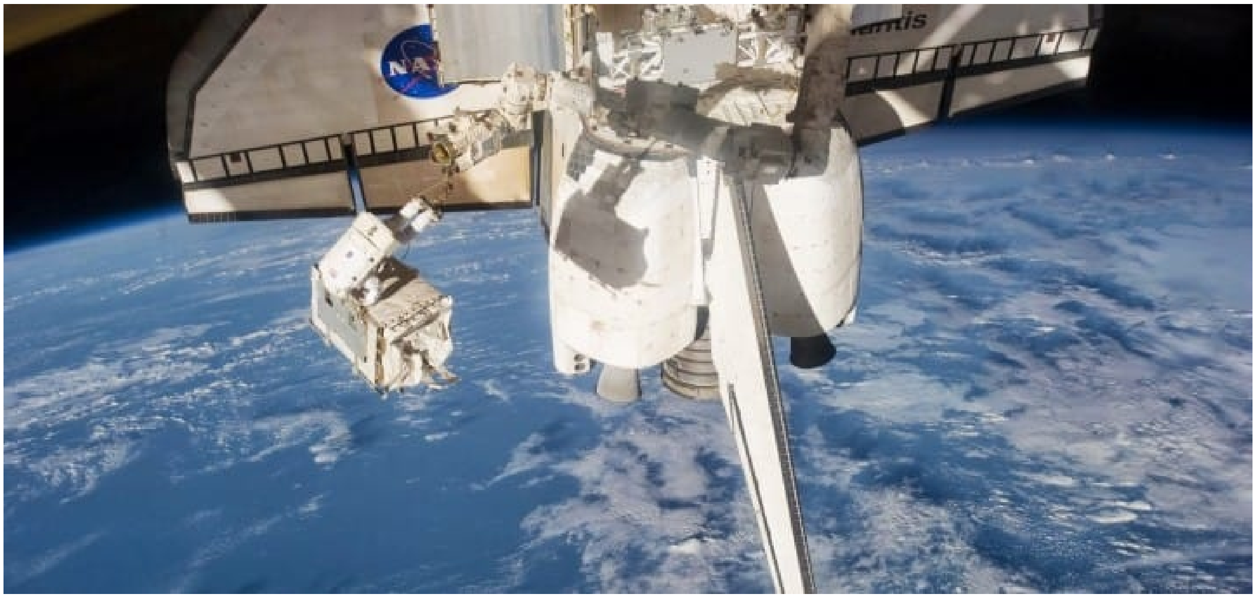
An Expedition 34 astronaut is trained in CPR (cardiopulmonary resuscitation) on the ISS. Source: NASA

My day will start with a refresher on the emergency response equipment, from the restraint table to the AED (Automated External Defibrillator) and the Respiratory Support Pack and then I'll move on to a class on the actual emergency response procedures. They're not unlike any procedure you might have learned in a first aid course, but optimized for the specific situation we have on-board, the equipment we have available and the fact that we can't call 112 or 911.

Later I'll have a meeting at the Food Lab to start discussing the content of my bonus food container and then I'll drive to the NBL for the 1G class of Friday's pool run. We call 1G classes the preparatory events in which the instructors describe to us the tasks for the upcoming run and we get to manipulate in a 1G environment, i.e. outside of the pool, the tools and equipment we'll be dealing with in the water. Some giant components can be very heavy in 1G, but the pool models are made as neutrally buoyant by adding foam. It's as close as it gets to weightlessness!

Italian translation of this logbook entry: L-483: Emergenze mediche in assenza di peso, by Paolo Amoroso—AstronautiNEWS.

L-482



"An ISS pump module is stowed in the Shuttle's cargo bay during STS-135. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.06—Training today has started with a class on the SAMS payload: that's the Space Acceleration Measurement System, a series of interconnected sensors throughout ISS that for over ten years have been characterizing the microgravity environment on Station. The internal cameras might be off past working hours, but the SAMS ground controllers always know from the acceleration telemetry whether it's bedtime on orbit or if there's still activity onboard!

The rest of the day I'll mainly be planning Friday's training run in the pool. As I already mentioned, we'll be practicing a contingency scenario in which we have to swap a pump module. That's a vital component, because it keeps cooling fluid running in one of our two external thermal control system loop. With one pump module down, we loose a lot of redundancy on Station, starting with half of the power supply. Replacing a pump module is a 3-EVA task, but on Friday we'll only practice one of them, EVA number 2. Prep work will already have been done and we'll be ready to slide the failed pump module out of its location and install a spare one.

A pump module has failed in the past! In the picture you can see a failed unit being stowed in the Shuttle payload bay during STS-135 two years ago. It gives you an idea of its size. And some units, like batteries, are even bigger!

Italian translation of this logbook entry: L-482: Qualcuno è ancora sveglio?, by Paolo Amoroso—AstronautiNEWS.

L-481

Samantha Cristoforetti and Alexander Gerst in the NBL pool. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.08.07—I'll be flying around ISS today!

Not really, but I will be scuba diving in the Neutral Buoyancy Laboratory (NBL) with my EVA instructor, Faruq, to prepare Friday's run in the pressure suit. And since we have a full scale replica of the ISS under water (except the Russian segment), it feels really like flying around Station!

Samantha Cristoforetti swims in the NBL around the replica of the ISS. Source: Samantha Cristoforetti

When the training schedule allows it, diving is a great preparation for a suited run. We can get a feel for translation paths, obstacles along the way, safety tether routing. And we can check out worksites and understand the geometry involved. What body position is better? How can I secure myself? Where should I attach my tool bag or temporarily stow a spare unit while we remove a failed one?

As you can see in the pictures, somehow you even meet a suited crewmember or two when you dive in the pool! Recognize my fellow Shenanigan Alex in this "old" picture?

Italian translation of this logbook entry: L-481: Volare intorno alla ISS… più o meno, by Paolo Amoroso—AstronautiNEWS.

L-480

Luca Parmitano sleeps in his apartment on the ISS. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.08—Today's training seems to be focused not so much on technical content, but rather on some aspects of functioning well as a human being, both on the ground and on ISS.

I'll start the day in a few minutes with my highly-anticipated briefing on sleep shifting. We sleep shift a lot in training, because of all the travel between training locations in different continents, but also on orbit, typically to support the arrival of new crewmembers or resupply vehicles.

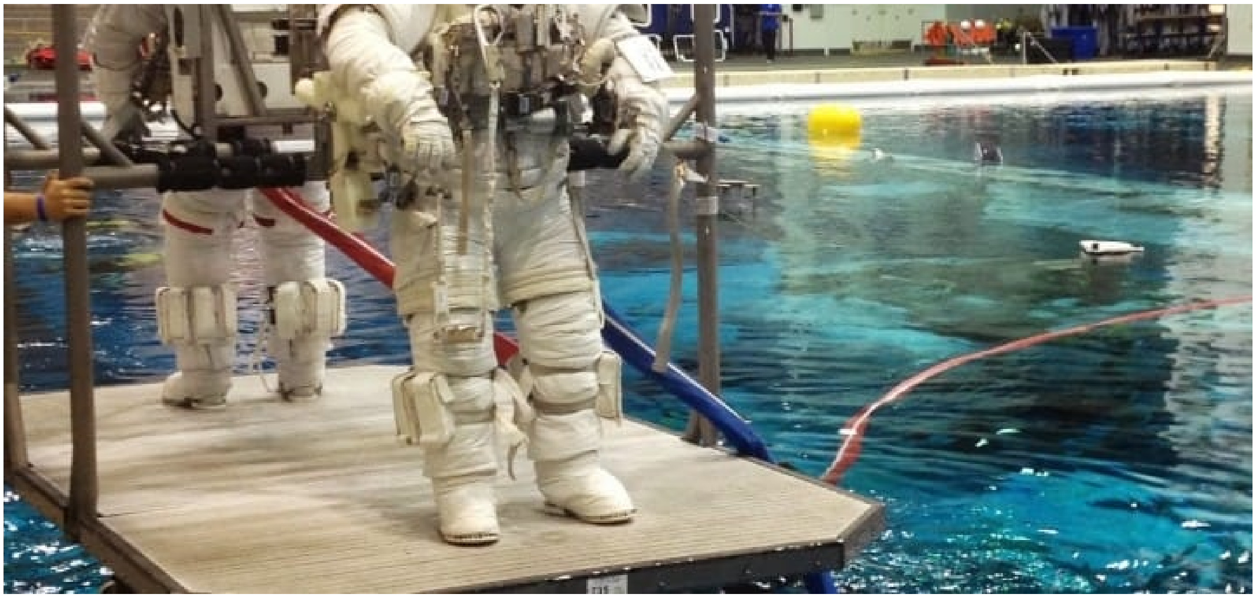
Key in sleep shifting is of course… sleeping. How good that my next class will be about the crew quarters on ISS. In the picture you can see my fellow Shenanigan +Luca Parmitano sleeping in his crew quarters on orbit!

Then I'll have a short class highlighting the procedures to be followed by crewmembers to download personal fotos and videos from ISS. Nothing ever gets lost, but following certain procedures ensures that you'll get certain material back quicker when you get back, for example to use it for post-flight presentations.

In the afternoon, on to a class about the Periodic Fitness Evaluation that we do on orbit. And finally, one more class on Cardio-Pulmonary Resuscitation (CPR).

Italian translation of this logbook entry: L-480: Dormire e essere umani nello spazio, by Paolo Amoroso—AstronautiNEWS.

L-479



Samantha Cristoforetti and Terry Virts are lowered into the NBL pool for an EVA simulation. Source: Josh Matthew

Johnson Space Center (Houston, USA), 2013.08.09—Late and short update today.

Terry and I ran one of the pump module replacement EVAs, as I mentioned in an earlier post. Days in the Neutral Buoyancy Lab are always long and full. We get there around 6:30 - 7:00 and then it's a busy program until around 17:00. We prepare all our tools on the pool-deck first thing in the morning, then the doctors sees us to make sure we're OK, then on to the briefing with the whole NBL team and back to the pool deck for suiting up. We work under water until 15:00 then we get the suit off, get a quick shower and it's debrief time!

It was great training, full of challenges and learning points. Now it's time to go and get a drink: I don't know how it happened, but it's already Friday night!

PS: thanks to our Chief Training Officer +Josh Matthew for coming out to the pool and for the pic!

Italian translation of this logbook entry: L-479: Una giornata piena sott’acqua ed è già venerdì sera, by Paolo Amoroso—AstronautiNEWS.

L-478

Chris Cassidy and Karen Nyberg in the Dome for the capture of HTV-4. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.10—It's weekend! Looking ahead to what's coming up next week, one of the big events will be a Track & Capture class with Butch (crewmate Barry Wilmore).

Track & Capture training prepares crewmembers for the grappling of a visiting vehicle, specifically the ones that we call Free Flyers, because they can not dock autonomously to ISS. All those cargo resupply ships (HTV, Dragon, Cygnus) have a grapple pin that can be captured with the end effector of the robotic arm and, right next to it, a visual target for the astronaut to align the arm properly. The "Track" part of it consists in matching the residual translation and rotation rates of the vehicles with respect to Station while it's in station keeping. Real vehicles have been pretty steady so far, but we see quite significant rates in training!

I've done a lot of solo Track & Capture training, meaning myself and the instructor. Next week's class with Butch will be the first one in which we practice coordination and team work with actual crewmates. While one person is at the hand controllers concentrating on the target and performing the capture, the second person has the overall awareness and runs the checklists in case of an off-nominal situation.

Btw, yesterday on orbit Karen Nyberg captured HTV-4 with the assistance of Chris Cassidy. You can see them at their Cupola workstation in this picture shared by Luca Parmitano.

Italian translation of this logbook entry: L-478: Inseguimento e cattura, by Paolo Amoroso—AstronautiNEWS.

L-477

Chris Hadfield performs a Periodic Fitness Assessment (PFE) on the ISS. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.11—One of the classes from last week I haven't talked much about is the introduction to the Periodic Fitness Assessment (PFE).

PFEs are scheduled periodically on orbit: the first one about 14 days after arrival to Station and then monthly thereafter. The exercise device of choice is the CEVIS (Cycle Ergometer with Vibration Isolation System), which is installed in the US Lab. Crewmembers are very familiar with CEVIS because they perform on it about half of their daily cardiovascular training sessions - the other half is on the treadmill T2.

The class I had last week was about setting up the equipment necessary for the PFE data collection: attaching the electrodes for the electrocardiogram, positioning the blood pressure cuff and the heart rate microphone, configuring all the cables and interfacing with the software to record the data.

For their PFE crewmembers perform an ad-hoc protocol based on their pre-flight VO2max. Data lands on the desk of their flight surgeon, who can track the evolution of the cardiovascular condition throughout the flight and possibly recommend adjustments of the training protocols.

In the picture you can see Chris Hadfield performing a PFE on orbit. And yes, the CEVIS we train with on the ground does have a seat and handlebars. On orbit, the shoes that can be attached rigidly to the pedals are all you need!

Italian translation of this logbook entry: L-477: Quanto siete in forma?, by Paolo Amoroso—AstronautiNEWS.

L-476

Chris Cassidy examines the EMU suits he used together with Luca Parmitano on the ISS. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.12—Starting the week with a long class on EMU maintenance operations.

The EMU (Extravehicular Mobility Unit) is the US pressure suit for spacewalks. It's like a little spaceship that you wear on yourself and keeps you alive for 7-8 hours in vacuum.

The suit has oxygen tanks that provide you with oxygen to breath and to keep the internal pressure at about 4.3 PSI. It also keeps you cool thanks to a sublimator that gets rid of excess heat. And of course it provides communication and protection against micrometeorite strikes and radiation.

There are periodic maintenance operations that are carried out on orbit and we will start learning about those in today's class. Sometimes there might also be the necessity to perform troubleshooting. That has been the case in recent weeks after the water leak problem in Luca

Parmitano's suit last month. In the picture you can see Chris Cassidy busy with some of that troubleshooting work!

Italian translation of this logbook entry: L-476: Manutenzione delle tute spaziali, by Paolo Amoroso—AstronautiNEWS.

L-475

Kevin Ford trains on the ISS ARED machine. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.13—Day started with an early exercise session on the ARED.

ARED stands for Advanced Resistive Exercise Machine. It's been on ISS for several years now and it has really made a huge difference in the effectiveness of resistive exercise in limiting bone loss in long duration crewmembers. We're scheduled every day for a session on ARED and we are given protocols that are especially designed to target critical areas of bone loss, like for example the hip.

Tolya Ivanishin trains on the ARED machine. Source: NASA

You can see in the pictures cosmonaut Tolya Ivanishin and [astronaut Kevin Ford] perform on orbit some of the many exercises you can do on ARED. It replicated the effect of working out with dumbbells and barbells, except that, as you can imagine, those would not be very effective in weightlessness. Instead, ARED has two big vacuum cylinders and we can set the resistance continuously in a very wide range.

The rest of the day will be dedicated to science, as I will get an initial overview of the experiment complement in my increment. Looking forward to start working on that soon!

Italian translation of this logbook entry: L-475: Esercizi con i manubri e i bilanceri, by Paolo Amoroso—AstronautiNEWS.

L-474

Samantha Cristoforetti in EMU suit in a EVA Prep & Post class. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.08.14—Today it's a Prep & Post day!

This is a full day training event in the airlock mock-up in which we go through all the procedures that need to be performed in the hours before and after an EVA. We basically simulate an EVA day, minus the time actually spent outside.

This is actually the Prep & Post class of my crewmate Butch. My role will be that of the "suit IV", so I will help with the suit donning and doffing, the prebreath protocol and the airlock depress/repress procedures. We prebreath to purge nitrogen from our blood, in order to prevent problems with decompression sickness. Remember that the suit is pressurized to only about 1/3 of atmospheric pressure!

I attach a picture of a Prep & Post class I did almost two years ago. Really time to refresh my knowledge!

Italian translation of this logbook entry: [L-474: Un giorno di passeggiata spaziale senza passeggiata], by Paolo Amoroso—AstronautiNEWS.

L-473

HTV-4 seen from Dome just before the capture with the robotic arm. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.15—Today I have the class on Track & Capture that I have talked about already in the L-478 Logbook.

There's a lot of preparation work involved in getting ready for a Free Flier rendezvous and subsequent capture. Usually a two-person team will swap leading role when it's time to transition to robotic operations. The VV1 (Visiting Vehicle Officer 1) who's had the primary responsibility during the rendezvous phase transitions to a supporting role during capture operations. VV2, on the other hand, will put hands on the controllers to perform the capture. We call that role M1.

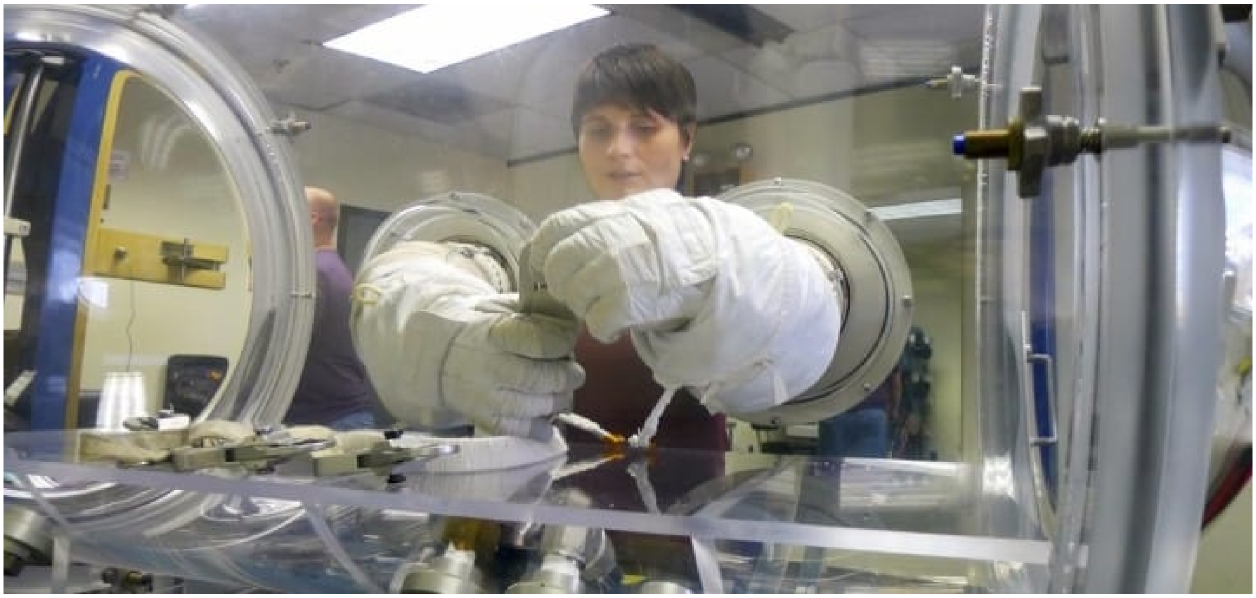
Dome configuration for the capture of HTV-4. Source: NASA

As you can see in the picture, it's quite a complex setup in the Cupola on a capture day. We have the robotic workstation, including the hand controllers, with which we fly the arm. But we also have the visiting vehicle control panel, with which we command it to free drift just before capture: when we grapple it and it becomes rigidly connected to station, we don't want its thrusters to fire so we deactivate its guidance systems and just let it free float in space for a few seconds. On the control panel we also have commands to send the vehicle away in an off-nominal situation. And of course, as you can see in the picture, we have a variety of monitors for external camera views and a few laptops.

I also attached a picture posted by Karen Nyberg of her view of HTV4 when she and Chris Cassidy captured it last week.

Italian translation of this logbook entry: L-473: La Cupola quando è tempo di cattura, by Paolo Amoroso—AstronautiNEWS.

L-472



Samantha Cristoforetti performs adaptation texts of the gloves of the EMU suit in the vacuum chamber. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.08.16—Just back from a glove fit check for the gloves I use in the NBL for EVA training.

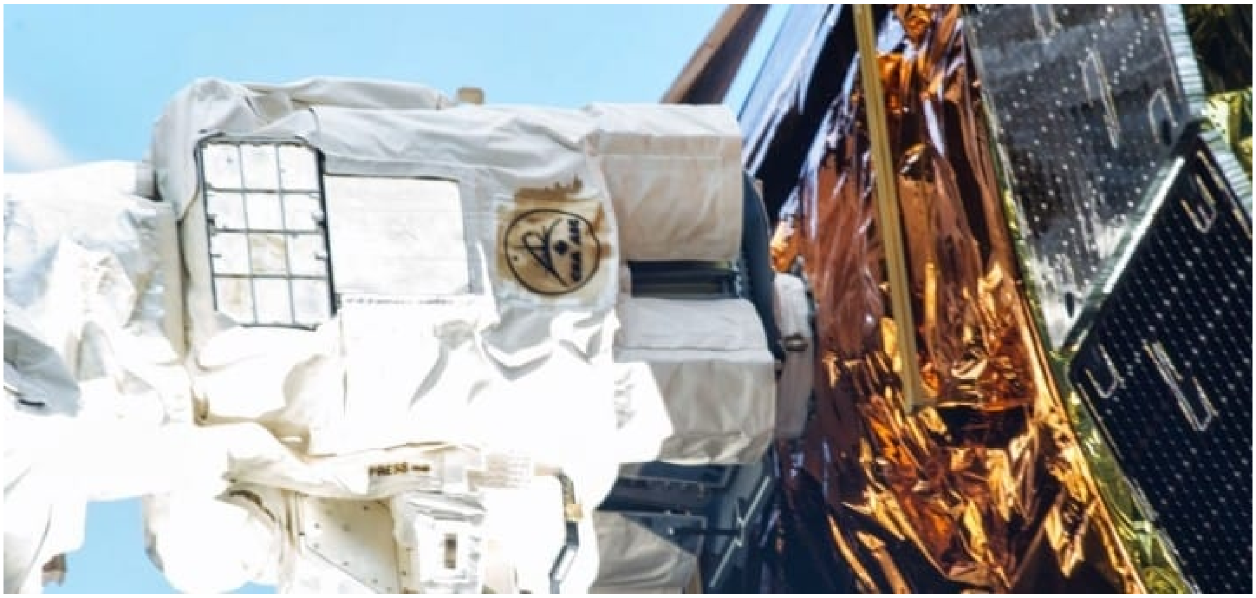
I have used these gloves throughout my training so far, but adjusting the gloves is an art and there is never a perfect, final result. There's always something different to try to make sure you can work well in the gloves. If the modifications we're trying are significant, our suit engineers will schedule a fit check to make sure that the overall glove configuration is still good.

They can adjust the finger lengths (withing a certain range) and they provide a number of different pads and comfort gloves of different thickness that we wear beneath the EVA gloves.

In the picture you can see the small vacuum chamber we test the gloves in. Air is pumped out of the chamber so that the overpressure in the gloves is 4.3 PSI, just like it is for an EVA.

Italian translation of this logbook entry: L-472: L'importanza di avere i guanti giusti, by Paolo Amoroso—AstronautiNEWS.

L-471

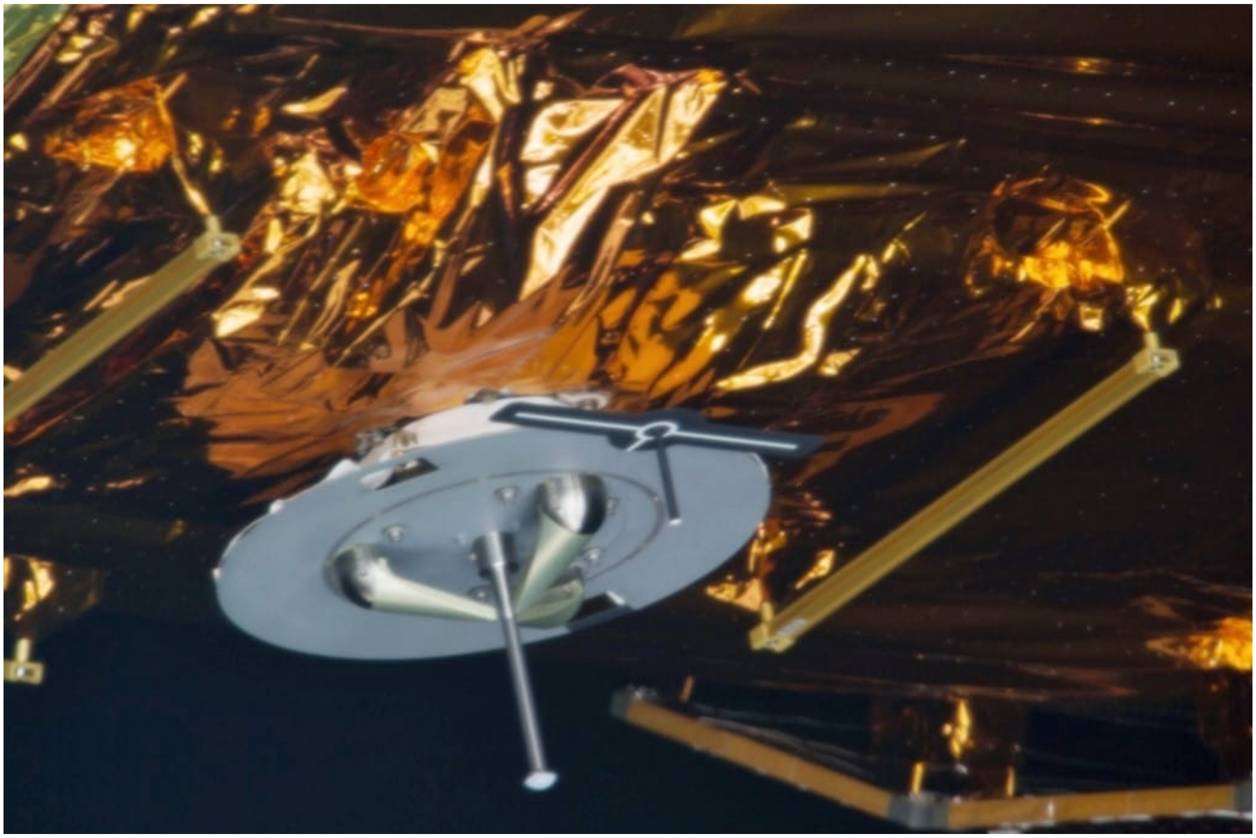


The end of the Canadarm 2 robotic arm hooked to the HTV-4 pin. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.17—I've talked about last week's Track & Capture class with Butch in the L-473 logbook.

In fact, I'll have another such class coming up next week, in which I'll have a chance to practice coordination and communication with a different crew-mate: Terry.

With all this Track & Capture training in the simulators I've been curious to see how the real hardware looks like, so I've taken a look at the pictures from last week's grapple of HTV4 by Karen Nyberg and Chris Cassidy. I really like these two close-ups taken before and after capture.



The pin is the target of HTV-4 before capture. Source: NASA

In the "before" pictures, the longer pin you see sticking out of the grapple fixture is the grapple pin: the snares of the arm end effector close around it when we squeeze the trigger - assuming of course that we are in the grapple envelope.

The white line and circle with the shorter pin sticking out is the visual target that we see in the end effector camera. You can see that the pin has a white dot in the center: when we observe the white dot inside the white circle in the camera view, we know that we have a sufficiently good alignment in pitch and yaw.

In the "after" picture you can probably recognize the end effector camera, facing straight down onto the target pin.

Italian translation of this logbook entry: L-471: I perni di presa e i perni bersaglio nello spazio, by Paolo Amoroso—AstronautiNEWS.

L-470

SSamantha Cristoforetti helps an astronaut colleague to wear the EMU suit for EVA. Source: Josh Matthew

.**Johnson Space Center (Houston, USA), 2013.08.18**—In the L-474 Logbook I have talked a bit about the Prep & Post class, in which I had the chance to perform the suit IV tasks for crewmate Butch and JAXA astronaut Norishige Kanai. As I mentioned then, the Prep & Post class is about all that happens in an EVA day, minus the time spent outside.

Airlock configuration is something we would take care of in earlier days, but sure enough the first procedures of the "day of" guide us through a final check to make sure that all equipment is in the proper configuration and all switches in the expected position.

Then we start the pre-breath protocol, whose goal is to purge nitrogen from the body to mitigate the risk of decompression sickness when exposed to the low pressure in the suit (about a third of atmospheric pressure): the EV crewmembers don their oxygen masks and the pre-breath clock starts.

We all work together to power up the suits and check their configuration and then it's time to take the suits apart, so that the EV crewmembers can don the lower component (legs, up to waist). Before they can come off the masks to don the upper part of the suit, we close the hatch to Node1 so that we are isolated from the rest of Station. We then reduce pressure in the airlock by about a third and wait for the oxygen concentration to stabilize at a higher percentage than normal to comply with the requirements of the pre-breath protocol.

Then it's time for me to help them don the suit. They need to "slide" the upper body into the suit torso and then it's my job to build the suit around them: connect the legs to the torso, attach the gloves, help then don the com cap, put the helmet on. It's hard work, especially in 1G! Luckily I had help and guidance from a suit technician.

After more verification steps on the suit and a leak check, we initiate a purge procedure to create a pure oxygen environment inside the suits and I reopen the hatch to Node1. At this point, I help the EV crewmembers work through the In-Suit-Light-Exercise protocol: for about 50 minutes they need to perform cycles of light exercise, mainly moving their legs, to bring up their metabolic rate and accelerate the purge of nitrogen.

Once that is complete, I'll help them move in the smaller section of the airlock (the one that is depressurized to vacuum), close the hatch behind them and get ready to assist in running the depressurization procedure once they reach a minimum of 100 min of in-suit pre-breath time.

As you can see, it's a long day before an EVA can even start!

PS: thanks to Josh Matthew for the pic!

Italian translation of this logbook entry: L-470: È una lunga giornata già prima che possa iniziare, by Paolo Amoroso—AstronautiNEWS.

L-469

ISS water sample containers for analysis. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.08.19—Water, water, water!

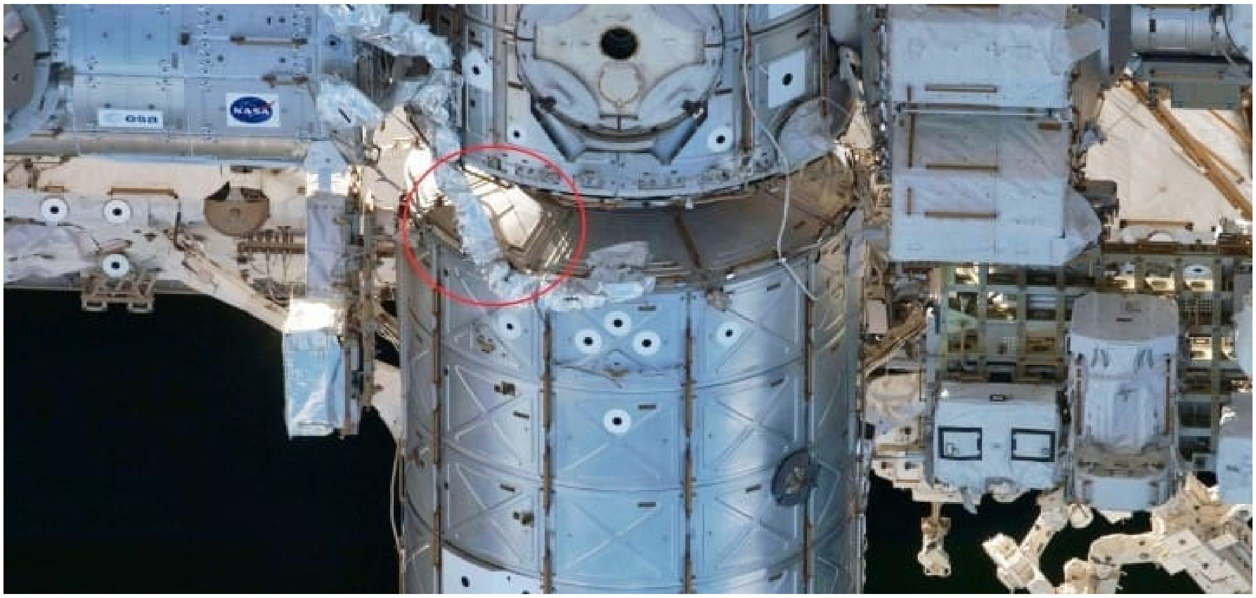
Water is extremely important on ISS and we take measures to monitor its quality on a regular basis. Today I took the first of a series of classes aimed at making me familiar with all the water sampling and analysis procedures that I'll be schedule to perform on orbit. This intro class focused on the equipment and the logistics. We'll have more integrated activities in future training events closer to flight.

Take a look at the picture! Don't you love color-coded? A color for microbiology anaylisis, one for the iodine analysis, another one for the Total Organic Carbon Analyser and one final color for return to Houston for ground analysis.

Did I mention that the water we drink onboard is mostly recycled from urine? That's the story for another day, but be assured: it's probably "cleaner" than most of the water we drink on Earth!

Italian translation of this logbook entry: L-469: Acqua, acqua, acqua!, by Paolo Amoroso—AstronautiNEWS.

L-468



The area of the ISS near the Node 1. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.20—I had a busy EVA and robotics day!

I got to capture Cygnus with the robotic arm for the first time today. As you might know, this is a new cargo resupply vehicle that will fly to Station for the first time probably next month. No big changes from the many HTV captures I've practiced so far, but a bit of a change of perspective: the grapple fixture is right next to the main engine nozzle! It's a bit strange to be looking through the arm camera straight into an engine's "business end", but of course engine firing will be inhibited at that point.

Then I had a preparatory class for Thursday EVA training in the Neutral Buoyancy Facility (see L-479 Logbook). We'll be practicing the replacement of an Interface Heat Exchanger on the Lab. In the picture you can see our worksite: we'll actually have to remove a couple of Lab panels to gain access to the component. It's a really tight place in the big suits, especially because, since this picture was taken, the PMM

(Permanent Multipurpose Module) has been attached to the free CBM on Node1. The CBM is the Common Berthing Mechanism and you can see it in the picture as well: it's the circle with the four petals.

Italian translation of this logbook entry: [L-468: Catturare Cygnus e fare EVA in spazi ristretti](), by Paolo Amoroso—AstronautiNEWS.

L-467

Samantha Cristoforetti waiting to be lowered into the NBL pool for an EVA training session. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.21—I spent the morning at the NBL today diving in preparation of my EVA training run tomorrow.

As I've mentioned before (see L-481 Logbook), diving is a great way of getting familiar with a task, especially in terms of translation paths and geometry of the worksite, as well as available handrails and other points of fixation.

Moreover, being immersed in the 3D space makes it a bit easier to picture how the safety tether routing will be. Safety tethers are anchored somewhere on structure, typically close to the airlock, and then unwind as you move away from the anchor point. We're always supposed to stay attached to structure, but if we ever made the mistake of floating off, the safety tether would pull us back towards its anchor.

Sometimes we attach two safety tethers together to have more length, as you can see in the picture - the blue foam is for water buoyancy concerns. And as you can read in this account of Luca Parmitano of his recent EVA water anomaly, a safety tether can save the day in a variety of ways!

Italian translation of this logbook entry: L-467: Come il cavo di sicurezza può salvarvi la giornata, by Paolo Amoroso—AstronautiNEWS.

L-466

Samantha Cristoforetti in the first NBL training session. Source: NASA

Johnson Space Center (Houston, USA), 2013.08.22—Just back from a long and challenging day at the NBL.

The Interface Heat Exchanger on the Lab endcone is one of those few components that we really, really hope never fails (see L-468 Logbook for the location). It is well-know that an EVA to go and replace it would be a very difficult one. Now I can confirm it from direct experience in the pool!

Time to grab dinner with a few friends now and later get ready to leave. I have some more training tomorrow morning and then I'm heading back to Europe in the afternoon.

Italian translation of this logbook entry: L-466: La EVA che tutti si augurano di non dover mai fare, by Paolo Amoroso—AstronautiNEWS.

L-465

Samantha Cristoforetti is trained in ultrasound to the eye. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.08.23—Half day of training fully devoted to science today before heading to the airport.

First thing in the morning my crewmates and I received brief presentations from a number of PIs (Principal Investigators) who are proposing experiments in which we would be required to serve as human subjects. It's their opportunity to present the scientific value of their investigations and for us to ask any questions we might have about the experiment protocols and about any risks and constraints involved. Actually, the risks are typically really minimal: before an experiment makes it to this point, it has been reviewed at multiple levels to make sure there are no concerns for the subjects.

Then I had the chance to practice making an ultrasound of my eye. Not on my own, of course. As far as I understand, it takes years to train an ultrasound operator. But hopefully now I will be able to implement instructions properly when I'll do this on Station under remote guidance from a ground-based operator.

Now it's time to drive to the airport and catch that plane to Europe!

Italian translation of this logbook entry: L-465: Farsi un'ecografia a un occhio, by Paolo Amoroso—AstronautiNEWS.

L-464

ESA EAC lobby in Cologne. Source: Paolo Amoroso

Cologne (Germany), 2013.08.24—Back in Europe after a long, but very smooth flight.

Early next week I'll take care of some administrative work at my homebase, the European Astronaut Centre (EAC). You know… email, paperwork, meetings. Plus a couple of interviews. After that I'll be on vacation for ten days. I'll be back at EAC on September 9th for Columbus training.

When there is no Space-To-Ground communication with the Space Station we say that we are LOS (Loss-Of-Signal). Short periods of LOS are normal and due to discontinuities in satellite coverage. So, this training logbook will be LOS for a couple of weeks.

So long and, as they say from Mission Control before the start of a planned LOS, "see you on the other side!".

Italian translation of this logbook entry: L-464: Ci vediamo dall'altra *parte!, by Paolo Amoroso—AstronautiNEWS.*

L-448

Samantha Cristoforetti in advanced training for Columbus systems at the EAC. Source: Samantha Cristoforetti

European Astronaut Centre (Cologne (Germany), 2013.09.09—Back from my vacation and ready for two weeks of training at home-base: the European Astronaut Centre in Cologne, Germany.

This week is dedicated to Europe's laboratory in space, the Columbus module. Not so much to the science that we do in Columbus - that's what we call payload training and it's for another time. But rather the actual Columbus systems, from thermal control system to power supply or data management.

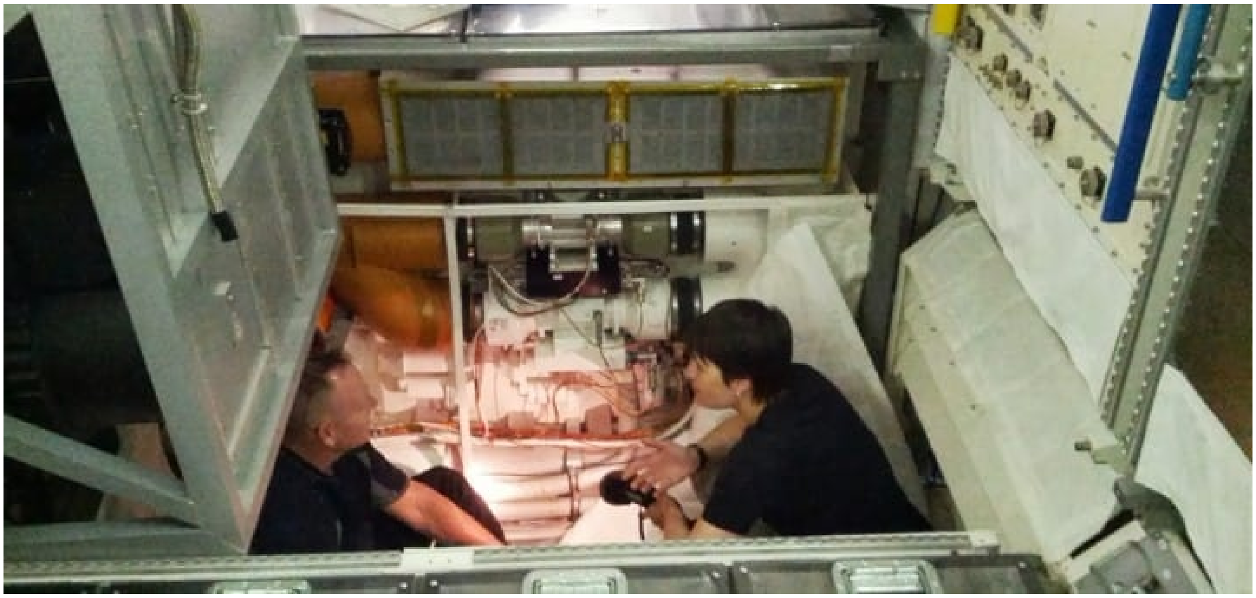
Specialized training for the Columbus module systems. Source: Samantha Cristoforetti

With my crewmate Butch I will receive specialist training this week. I'll tell you more in the next days about the different levels of qualifications we can have on the ISS systems, but one thing to know is that at any time we need at least a specialist-trained crewmember onboard for each ISS module/system. When European astronauts are on ISS, of course we're the Columbus specialist!

Today Butch and I had several lessons on different systems, including what we call structure and mechanisms. That's when we got to practice rotating a rack. Imagine that in your house you had wardrobes on all your walls, as well as the ceiling and the floor. That's the way it is on the Space Station. Each of of these elements, that we call racks, is hinged on one one side and can be rotated, for example to provide access to neighboring locations for maintenance purposes. Some racks are easier than others to rotate and it's good to have some practice with the trickier ones.

Italian translation of this logbook entry: L-448: Di ritorno dalle vacanze, by Paolo Amoroso—AstronautiNEWS.

L-447



Samantha Cristoforetti at work in a housing of a Columbus rack. Source: Samantha Cristoforetti

European Astronaut Centre (Cologne (Germany), 2013.09.10— Second day of Columbus specialist training with crewmate Butch.

Yesterday I mentioned that we have to rotate racks out of the way sometimes to access hardware. One example is the Columbus port endcone, which contains a lot of critical ECLSS equipment.

ECLSS is the Environmental Control and Life Support System. The ECLSS in Columbus is highly integrated with the rest of the ISS and does not have an autonomous capability of air revitalization, meaning CO_2 scrubbing and oxygen introduction. That's not a problem, though, because many fans at the module interfaces force air to circulate throughout Station.

Columbus does have its own air conditioning system though. Condensate heat exchangers, that cool down and dehumidify the cabin air, are in the Deck1 rack that Butch and I rotated up in the picture. The endcone equipment in front of us is mainly redundant cabin fans with their filters and ducting.

Also hidden down there are several shut-off valves that allow for interruption of the fluid exchange between Columbus and the rest of ISS: the nitrogen supply lines for our experiment racks, for example, but also the condensate line that brings back the water recovered from the cabin air for reprocessing in Node 3.

If we had to isolate Columbus for a contingency situation we would have to close those valves. Luckily they are motorized and can be controlled remotely, but if the motor failed we would have to rotate the rack and dive in the belly of Columbus to actuate them manually!

Italian translation of this logbook entry: L-447: Immergersi nella pancia di Columbus, by Paolo Amoroso—AstronautiNEWS.

L-446

Samantha Cristoforetti trains for Columbus laptop maintenance. Source: Samantha Cristoforetti

European Astronaut Centre (Cologne (Germany), 2013.09.11— Laptops, laptops, laptops!

Continuing with our Columbus specialist training, today Butch and I spent some time with our instructor Bernd looking at some maintenance tasks related to the Columbus laptop.

We have many, many laptops on ISS and no, not all laptops are created equal. Some laptops, that we call PCS, are on the ISS control bus and have displays that allow crewmembers to monitor the status of onboard systems and to send commands. Truth to be told, most system commanding is done from the ground by specialists sitting on console in the various control centers. As crewmembers we are mainly trained on procedures that would be critical in case of an emergency or a loss of communication situation.

Columbus, just like the Japanese laboratory JEM, has its own laptop for telemetry and commanding, which is called PWS. I hope you're not getting tired of acronyms already, because this is just the beginning!

We also have SSC laptops that are not on the control bus and contain application software for planning, procedure viewing, inventory management but also videoconferencing and IP phone calls.

Finally for internet access and some more application software we have CSL laptops.

Oh, I almost forgot: lots of experiment racks come with their own dedicated laptop as well!

Italian translation of this logbook entry: L-446: Laptop, laptop, laptop!, by Paolo Amoroso—AstronautiNEWS.

L-445

Luca Parmitano replaces a Columbus Water Pump Assembly. Source: NASA

European Astronaut Centre (Cologne (Germany), 2013.09.12—Now you have a water leak in Columbus: what do you do? Butch and I were trained on that in one of our Columbus specialist classes today.

First of all, why do we have water lines in Columbus, as well as throughout ISS, with the exception of the Russian segment? That's how we cool our equipment! And it's also how we cool the the cabin air, thanks to dedicated heat exchangers: that's our air conditioning system. Think about how hot your laptop computer can get and now imagine how much heat we generate on ISS with so many computers and other electromechanical components! All that heat is collected by cooling water, then transferred to the ammonia lines outside ISS and finally rejected to space through the radiators.

So, a water leak is a really bad thing. Not only, or not so much, because you have a water spill, but because you're progressively loosing cooling efficiency and your equipment will soon overheat. Let's be clear:

Columbus is pretty aggressive when it comes to protecting itself. If a certain amount of water is lost, it will pretty much shut itself down and leave only vital equipment running, reducing the thermal load to the point that no active water cooling is required.

But since we don't want that to happen, we have procedures that have us work together with the ground in a coordinated effort to pinpoint the leak as fast as possible and isolate it. Since most of the possible leak locations are not in plain view, the hunt can be long!

One of the possible culprits in a water leak scenario could be the Water Pump Assembly. Good thing that Luca replaced a failed one on ISS a few months ago, so that we're now back to full redundancy. You can see him in action in the picture!

Italian translation of this logbook entry: L-445: Avete una perdita d'acqua: cosa fate?, by Paolo Amoroso—AstronautiNEWS.

L-444

Columbus mockup at ESA EAC in Cologne. Source: Samantha Cristoforetti

European Astronaut Centre (Cologne (Germany), 2013.09.13—As of today, Butch and I are officially Columbus specialists!

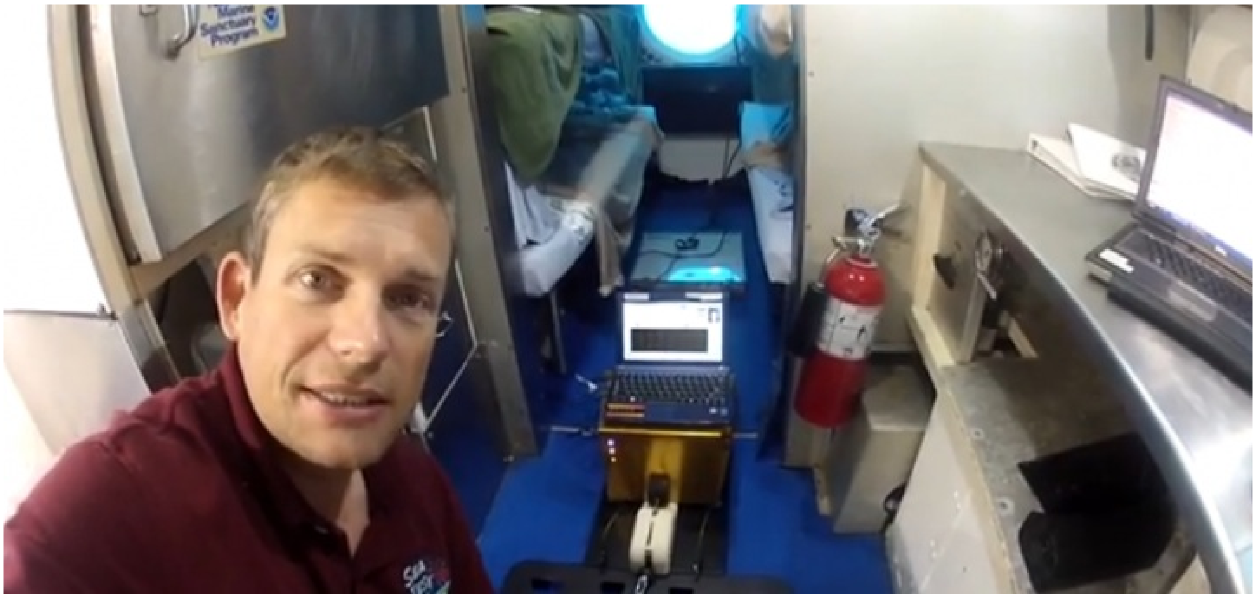
Our training week finished this morning with an evaluation simulation in the Columbus mock-up. And in terms of Columbus systems training, this is it until flight. Except for a quick refresher of a couple of hours in the final months before launch, next time I'll do any work on Columbus systems will be on the real flight hardware in space. Feels kind of strange, actually.

While we were running the simulation inside the mock-up, a lot was going on outside: the team here is getting ready to welcome a lot of visitors in little over a week. The European Astronaut Center will open its doors on September 22nd as part of a big open day of the entire German Aerospace Centre that we are co-located with.

At EAC we'll have tours of the training facilities throughout the day and a rich stage program. If you can make it to Cologne, we're really looking forward to seeing you!

Italian translation of this logbook entry: L-444: Non vediamo l'ora di incontrarvi!, by Paolo Amoroso—AstronautiNEWS.

L-443

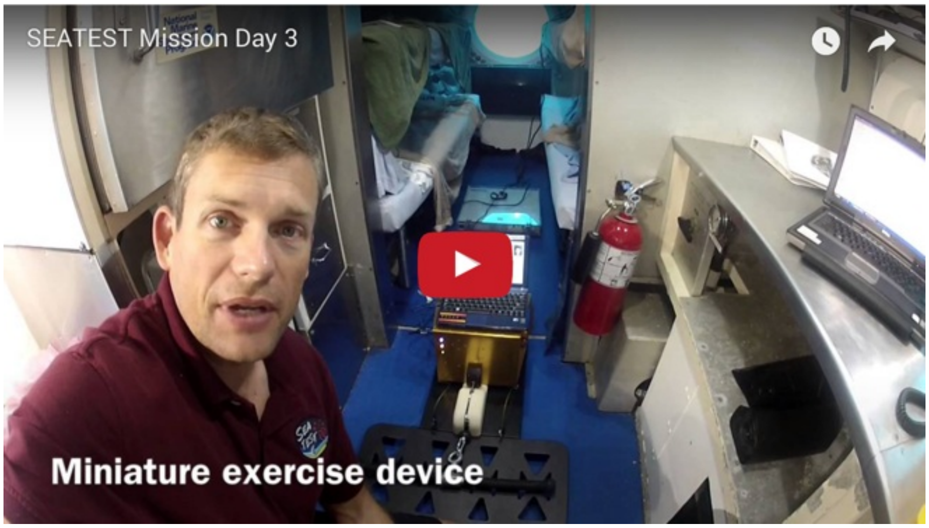


Andreas Mogensen tests a small exerciser in the Aquarius habitat during the SEATEST mission. Source: Andreas Mogensen / ESA

Cologne (Germany), 2013.09.14—Enjoying a rare weekend at home in Cologne: no training except, as usual, working out.

Strength and endurance training are daily activities for astronauts onboard the International Space Station. We have very effective equipment onboard that helps us reduce muscle and bone loss associated with long exposure to weightlessness. But that equipment is also quite bulky. Consider that the ISS is a gigantic space vehicle compared to anything we will use in the future for space exploration beyond Low Earth Orbit, so we'll probably need smaller devices in the future.

Looks like fellow Shenanigan Andreas Mogensen got to assemble and test such a device during his SEATEST mission in the Aquarius underwater habitat. Take a look at his video report!



Video: SEATEST Mission Day 3 (2:04)

Italian translation of this logbook entry: L-443: L'avventura sottomarina di Andreas Mogensen, by Paolo Amoroso—AstronautiNEWS.

L-442

ATV-3 Johannes Kepler maneuver thrusters just before docking at the ISS. Source: NASA

Cologne (Germany), 2013.09.15—Next week at the European Astronaut Center my crewmate Sasha and I will have our first week of ATV training.

ATV is the Automated Transfer Vehicle, the cargo resupply spaceship of the European Space Agency. It docks automatically to the Service Module of the Russian Segment using the Russian Docking System (the same one as the Soyuz) but a different suite of extremely precise docking sensors.

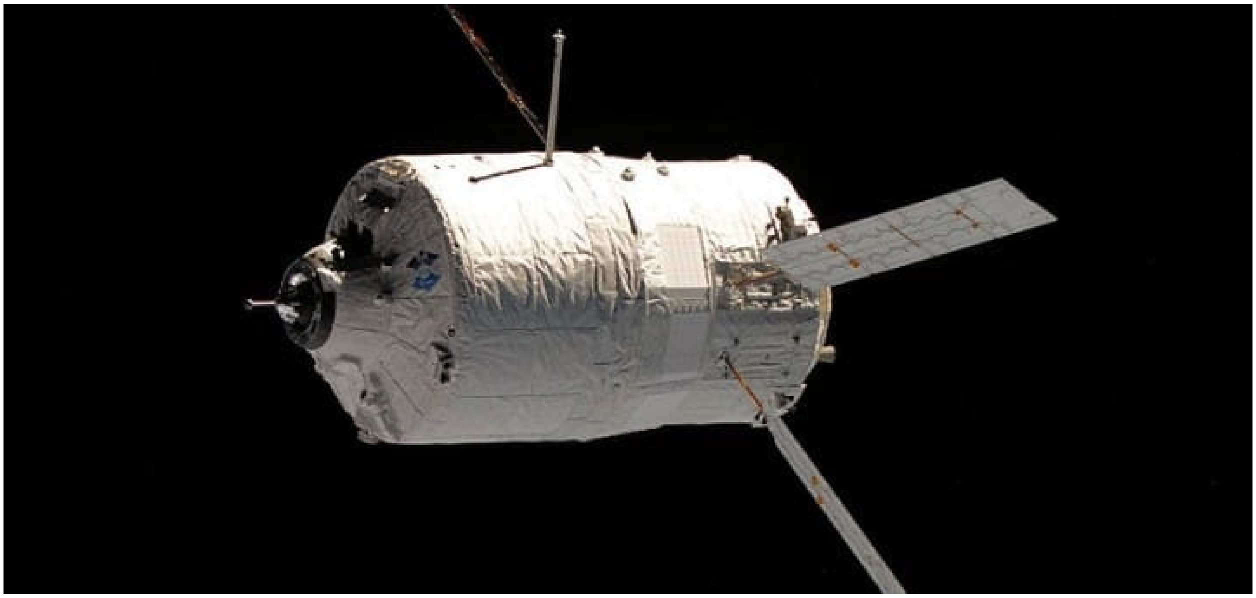
You can not take over control of ATV from ISS and fly it manually to docking, but crews are trained to monitor the rendezvous and send contingency commands to interrupt the approach if necessary.

So far, four ATVs have flown and all of them have docked flawlessly with great precision. ATV4 Albert Einstein is on ISS right now. The last one, ATV5 Georges Lemaître will fly next year and should still be on Station when my crewmates and I arrive.

In this beautiful picture, taken by Don Pettit, you can see the arrival of ATV3 Edoardo Amaldi last year!

Italian translation of this logbook entry: L-442: Parliamo un po' di ATV, by Paolo Amoroso—AstronautiNEWS.

L-441



ATV-2 Johannes Kepler. Source NASA

European Astronaut Centre (Cologne (Germany), 2013.09.16—The ATV training week has started today at EAC… without me.

I've actually received a waiver for today's and tomorrow's theoretical lessons, since I already had those classes during basic training.Instead of the full lessons, I had a review with an instructor who also verified that I still possess the required knowledge. I will join my crewmate Sasha in the sim starting Wednesday.

One of the lessons that were waived covers the distribution of responsibility between the ATV Control Center (ATV-CC) in Toulouse and Mission Control Center (MCC) Moscow.

ATV-CC is of course in control of the vehicle: it monitors the status of ATV and the execution of the mission profile and it uploads commands as necessary. However, during the rendez-vous and docking phase MCC-Moscow has mission authority, since ATV docks to the Russian segment of the ISS. In fact, crew on orbit talks to Moscow during ATV approach and docking. That's why we practice coms in Russian also during our sims at EAC!

Back to ATV-CC, though. If you're curious about how work is organized in Toulouse, take a look at this nice post on the ATV blog!

Italian translation of this logbook entry: L-441: Perché qualche volta parliamo russo a Colonia, by Paolo Amoroso—AstronautiNEWS.

L-440

Cady Coleman in his ISS accommodation. Source: NASA

European Astronaut Centre (Cologne (Germany), 2013.09.17—Today I had a chance to help the development process of an experiment that I will perform on ISS during my mission.

Many astronauts report that they don't sleep as well on ISS as they do on the ground. Most tend to sleep a bit less than on Earth and feel somewhat less rested.

The experiment in question aims at studying the heart activity during sleep. Thanks to a series of sensors embedded in a tight-fitting T-shirt, an electrocardiogram can be recorded while the astronaut sleeps. Also, an 3-axis accelerometer placed on the sternum can record data that can give insight into the cardiac mechanics in microgravity. While I was trying the T-shirt on today, the Primary Investigator could show me on the accelerometer traces the opening and closing of the different valves of my heart. Pretty cool, ah?

Investigating these phenomena on healthy people in unique environments (like microgravity) can give scientists insight that can help sick people on Earth. For examples, the same micro-awakenings that this experiment aims to observe in astronauts (via their heart rate variance) have been tentatively shown to exist in narcoleptic people. Learned a lot again today!

In the picture, my good friend Cady Coleman peaking out of her crew quarters on ISS!

Italian translation of this logbook entry: L-440: Quando il tuo sonno diventa ricerca scientifica, by Paolo Amoroso—AstronautiNEWS.

L-439

An astronaut enters the ATV. Source: NASA

European Astronaut Centre (Cologne (Germany), 2013.09.18—I have picked up ATV training with crewmate Sasha today.

One of the classes dealt with the operations related to ingressing ATV after docking. Sounds easy enough, but ingress operations actually take several hours.

For one thing, before opening any hatch you need to make sure that you have a good seal between Station and the vehicle itself. We call these type of procedures leak checks: you basically create a pressure differential between two volumes that are sealed off and check that the pressure equalization across the seal over a certain time is within the limits.

Once the leak check is passed and you open the hatch, it's time to take a long series of air samples, part for return to ground and part to test onboard for different contaminants.

Then you need to install an air filter and let it fully clean the ATV atmosphere for many hours. Only after the filtering is complete are you allowed to enter ATV without protective mask and goggles. If you think about it, it makes sense: on Earth, small particles fall to the ground, but in space they float, so they can easily get into your eyes or your lungs. Of course, we don't expect that on space vehicles, which are prepared in clean rooms, but better be safe than sorry!

You can see in the picture a crewmember entering ATV with protective gear. And what are those yellow things? Those are clamps that are installed on the hatch to increase the mechanic rigidity of the link between ATV and Station. After all, an ATV is a much bigger beast than a Progress or a Soyuz!

Those clamps are pretty interesting. Since you need to be able to close a hatch quickly in an emergency, they are designed so that you just need to pull on the string of one and they all come off. Just make sure you don't have your fingers in the way when the spring loaded lever snaps to the release position!

Italian translation of this logbook entry: L-439: Per entrare nell’ATV non basta aprire il portello, by Paolo Amoroso—AstronautiNEWS.

L-438

Samantha Cristoforetti installed the air filter in the ATV mockup in a training session at the EAC in Cologne. Source: Samantha Cristoforetti

European Astronaut Centre (Cologne (Germany), 2013.09.19—Some more ATV training with Sasha today!

We starting delving into the world of rendez-vous and docking malfunctions: all those scenarios that would cause us to send a manual command to interrupt the approach of ATV.

We also had an evaluation simulation on ATV emergencies, in particular the cases of fire in ATV and of a Station depressurization with the leak located in ATV.

A lot of the emergency procedures are common to generic station-wide response we train in Houston, but there are some peculiarities related to ATV. The main one is that it is a vehicle that can, and must eventually undock Station. If you're going to close the hatch of ATV in an emergency knowing that you will never open it again, you better make sure you leave the vehicle in a configuration in which it can safely undock and fly autonomously until atmospheric reentry!

All the ingress operations we worked on yesterday were very helpful for today's sim, because we were familiar with the location of equipment. In the picture, you can see us yesterday working on the installation of the air filter.

Italian translation of this logbook entry: L-438: Addestramento alle emergenze di ATV, by Paolo Amoroso—AstronautiNEWS.

L-437

Samantha Cristoforetti in the ATV mockup at the EAC in Cologne. Source: Samantha Cristoforetti

European Astronaut Centre (Cologne (Germany), 2013.09.20—Today Sasha and I finished Part1 of ATV training.

First we got to see some In-Flight-Maintenance procedures concerning the replacement of cabin fan and smoke detectors.

Then we had a pretty long paper-based test aimed at assessing our knowledge and understanding of the malfunctions that can occur during docking and rendez-vous. When we come back for another week of ATV training in November we'll spend most of the time in the simulator practicing our reactions to these malfunctions.

Here's a pic with a good view of our ATV mockup at EAC. Btw, if you come and visit us on Sunday on our Open Day, you'll also get a tour inside!

Here's more info.

Italian translation of this logbook entry: [L-437: Completata la settimana su ATV, esame superato], by Paolo Amoroso—AstronautiNEWS.

L-436

The tent that prevents the atmosphere of ATV from mixing with that of the ISS installed in the mockup at the EAC in Cologne. Source: Samantha Cristoforetti

Cologne (Germany), 2013.09.21—Sharing a couple more pictures from our ATV training last week.

As I mentioned in the L-439 Logbook, one of the initial ingress operations consists in installing an air filter that cleans the atmosphere of the newly arrived vehicle.

Before letting the filter do its job over the next several hours, we install a curtain, as you can see in the picture. This little trick prevents ATV atmosphere from mixing with Station atmosphere while the filtering is ongoing.

You can also see our mockup of the filter itself in the other picture. Btw, in the real vehicle we install the filter on the endcone: that door of course doesn't exist] But in our mockup getting through the hatch from the Service Module is rather cumbersome, since unfortunately we can not float: hence the extra door on the "vacuum" side!

Installing the ATV air filter. Source: Samantha Cristoforetti

One final reminder of our Open Day tomorrow at the European Astronaut Centre! Unfortunately, I have to take care of a personal issue that has arisen last minute, so I will not be able to participate.

Italian translation of this logbook entry: L-436: Una tenda in ATV, by Paolo Amoroso—AstronautiNEWS.

L-434

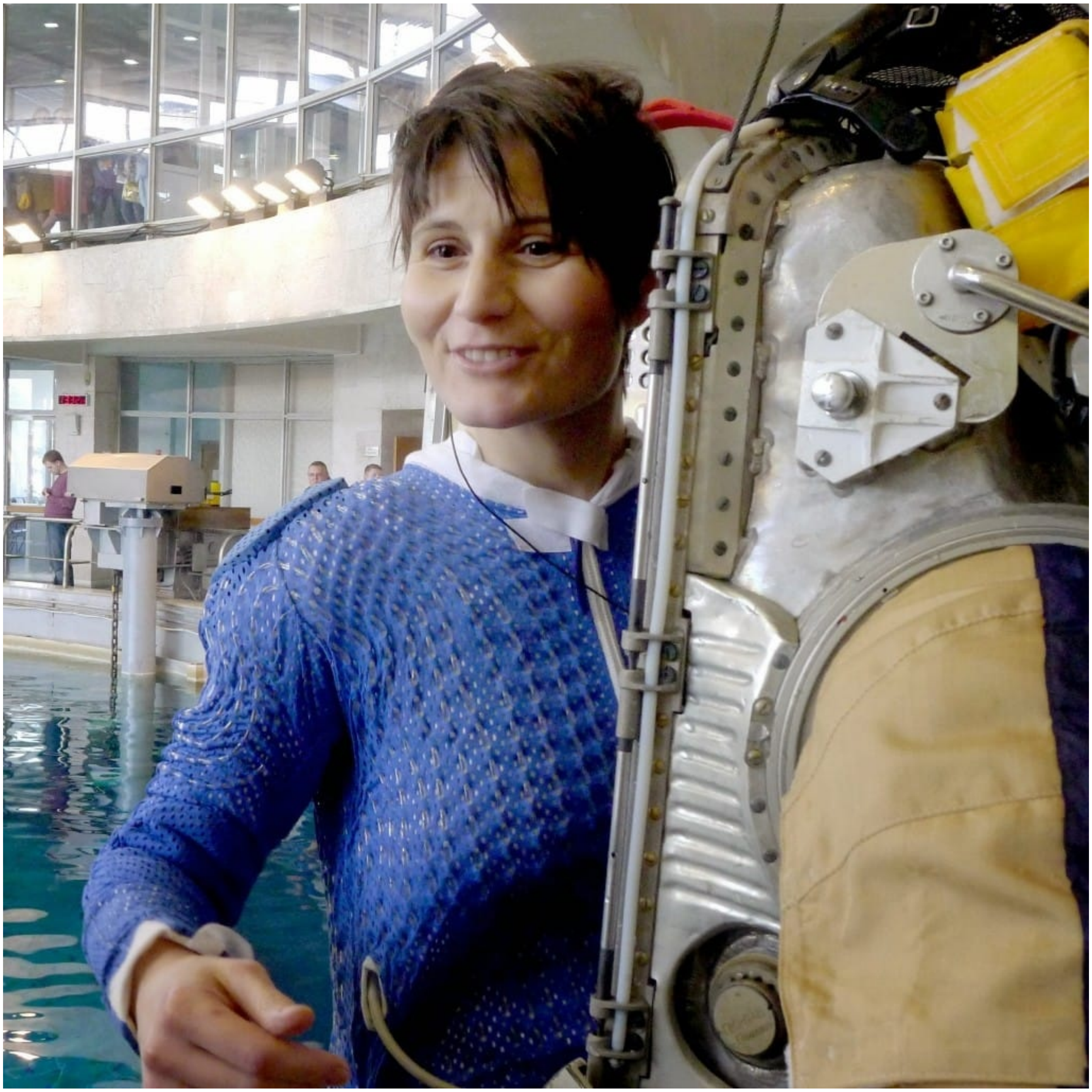
Samantha Cristoforetti after an EVA training session with the Orlan suit at the Star City Hydrolab. Source: Gagarin Cosmonaut Training Center

Francoforte (Germania), 2013.09.23—After a day of recovery at home yesterday - sorry I missed our Open Day and SocialSpace! - and a Shenanigans tagup with management and colleagues this morning on a variety of topics - thanks Thomas Pesquet for organizing this! - it's time to hit the road again.

I'm at the Frankfurt airport waiting to baord my flight to Moscow to pick up training in Star City tomorrow.

Really busy week in the Hydrolab coming up, first with some preparatory scuba diving tomorrow and then two training runs in the Orlan suit on Wednesday and Friday. Also on the training plan Soyuz sims with my Commander Anton and emergency training on the Russian segment of ISS.

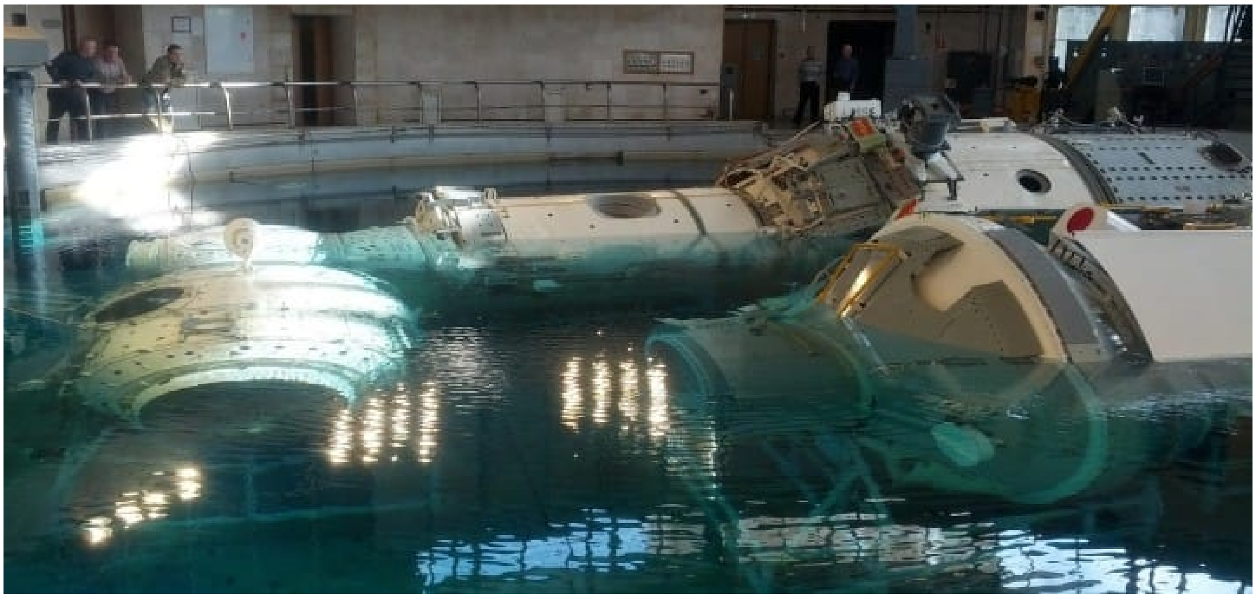
I'm sharing a picture from Orlan training back in April: judging from my hair, I'd say it was taken after the run!



After a training session at the Star City Hydrolab. Source: Gagarin Cosmonaut Training Center

Italian translation of this logbook entry: [L-434: Verso Star City](), by Paolo Amoroso—AstronautiNEWS.

L-433



The Hydrolab of Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.09.24—Back in Star City!

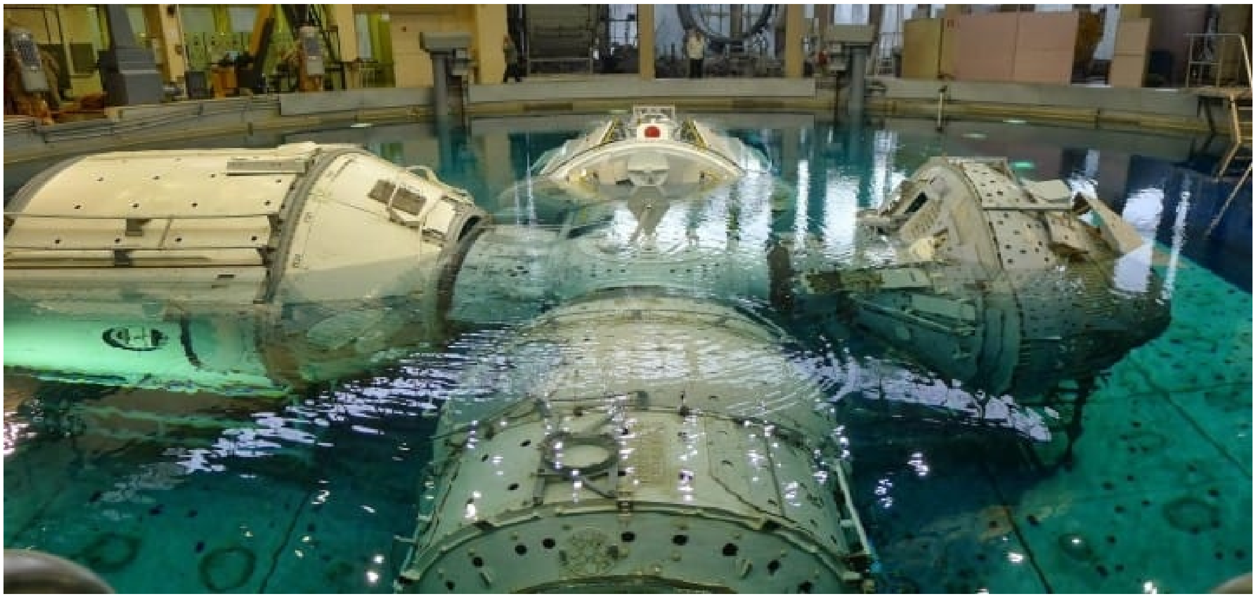
Sometimes getting from one place to another on the surface of the planet seems more difficult than going to space. So it happened that I was a bit delayed and only made it to Star City early this afternoon.

Too late for scuba diving in the Hydrolab, unfortunately, but early enough to get an extensive briefing of the tasks Sasha and I will practice under water tomorrow. The nice things about the Hydrolab is that you can raise the platform with the ISS mockups, so you can take a close look even without putting your scuba gear on.

You can read much more about the Orlan training in the attached post on the Shenanigans blog.

Italian translation of this logbook entry: L-433: Prepararsi alla simulazione Orlan di domani, by Paolo Amoroso—AstronautiNEWS.

L-432



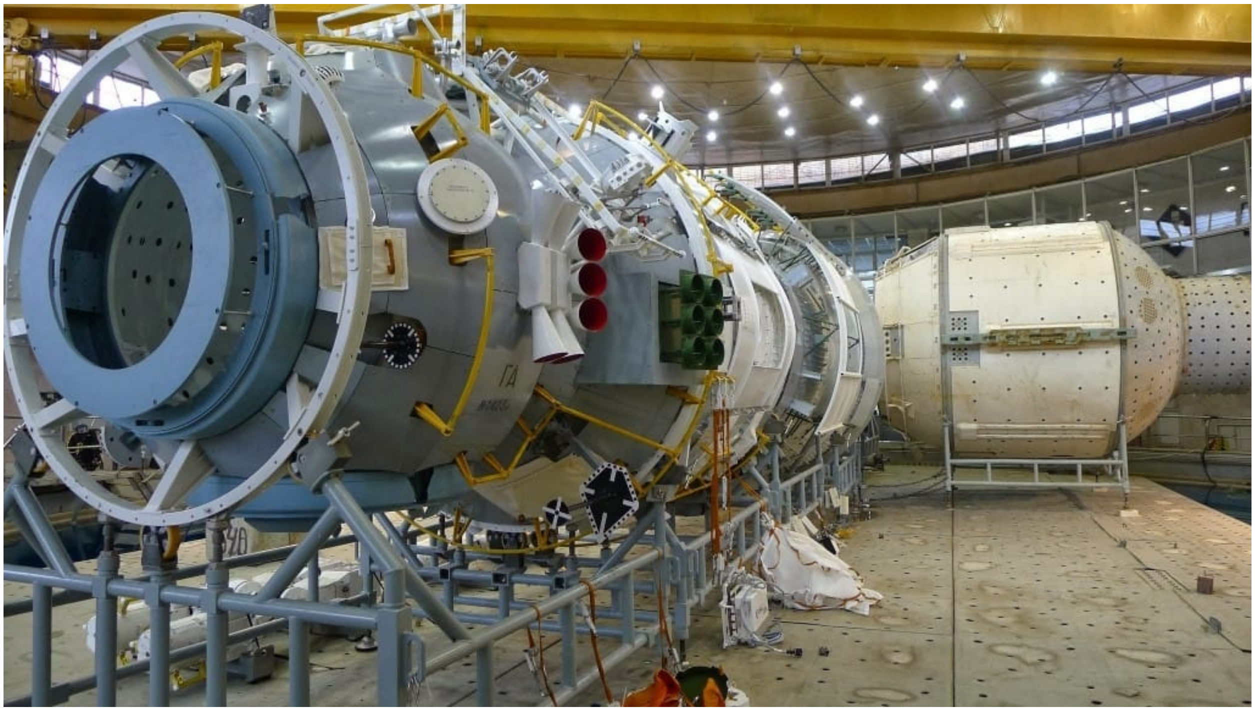
Mockup of the Russian section of the ISS at the Star City Hydrolab. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.09.25—Challenging day in the Orlan today!

With crewmate Sasha we showed up at the Hydrolab at 9:00 and, after seeing the doctor, we changed into our cooling undergarments and had some time to set up our tools and bags.

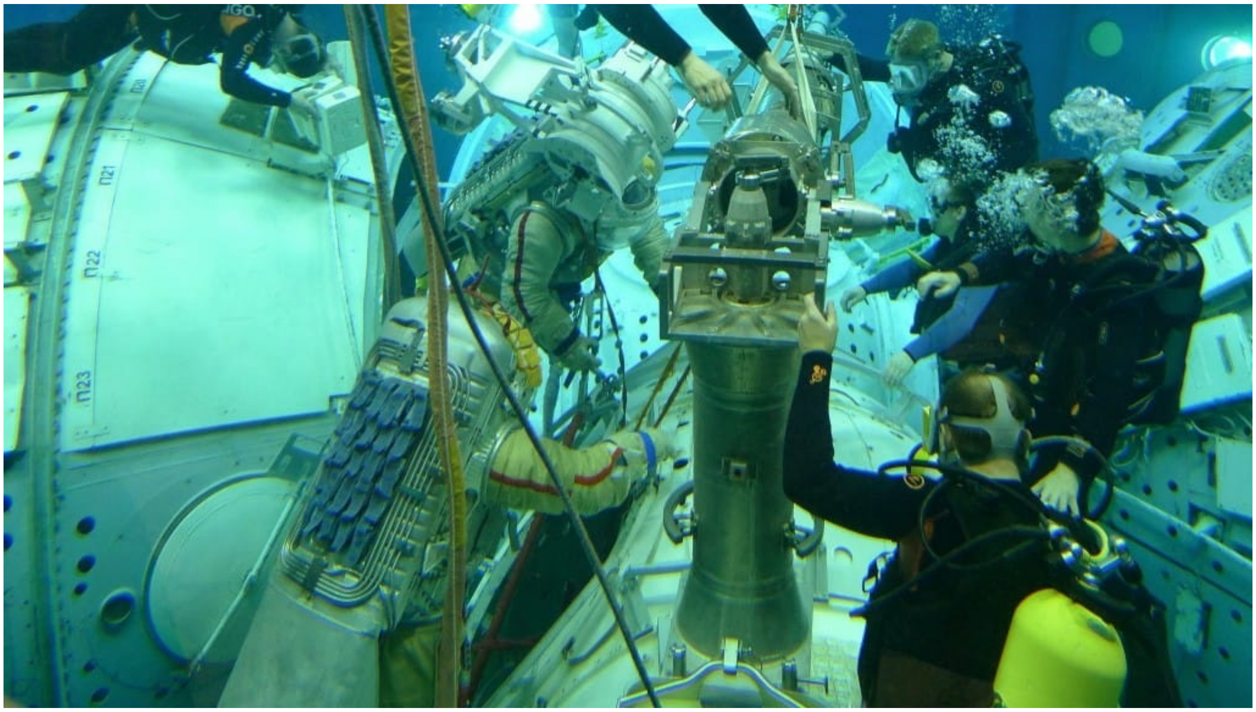
Preparing the equipment. Source: Samantha Cristoforetti

Then we had spent about four hours in the water practicing tasks mainly on the Mini Laboratory Module (MLM), a new Russian element that should be launched next year. You can see the MLM mockup in the picture showing the platform before it was lowered in the water.



MLM Mockup at Star City's Hydrolab. Source: Samantha Cristoforetti

Lowered in Hydrolab. Source: Samantha Cristoforetti



At work in Hydrolab. Source: Samantha Cristoforetti

Of course after the training we had a debrief with our instructors. I assure you, we were not posing [in that debrief picture]!

With Sasha at the debriefing after the Hydrolab simulation. Source: Samantha Cristoforetti

After a late lunch, there was still time to brief tomorrow's Soyuz sim with my Soyuz commander Anton and our instructor. We'll have our sim first thing tomorrow morning. Did I mention already that I love being in the Soyuz simulator?

Italian translation of this logbook entry: L-432: Addestramento in tuta Orlan, by Paolo Amoroso—AstronautiNEWS.

L-431

Paolo Nespoli and his crew in a fire simulation in the mockup of the Russian segment of the ISS in Star City. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2013.09.26—Four hours of Soyuz sim this morning with Anton. And we didn't have any major engine or computer failures today, not even a fire or a depressurization.

But we certainly were not bored. The instructor threw at us many little malfunctions that we don't see very often and are not so easy to detect. They might not kill you, but for sure they can easily turn your 6-hour trip to ISS into a two-day trip, if not dealt with properly.

After lunch, I had a theoretical lesson with Terry about fighing fires in the Russian segment: how the smoke detectors work, what kind of gas masks and fire extinguishers we have, where they are located, what are the rules of engagement. Next we'll have a practical session in the mockups, similar to the one you can see [in the picture] with ESA astronaut Paolo Nespoli.

Italian translation of this logbook entry: [L-431: Incendi e malfunzionamenti insidiosi](), by Paolo Amoroso—AstronautiNEWS.

L-430

Samantha Cristoforetti in Orlan suit after an EVA simulation in Star City's Hydrolab. Source: Samantha Cristoforetti

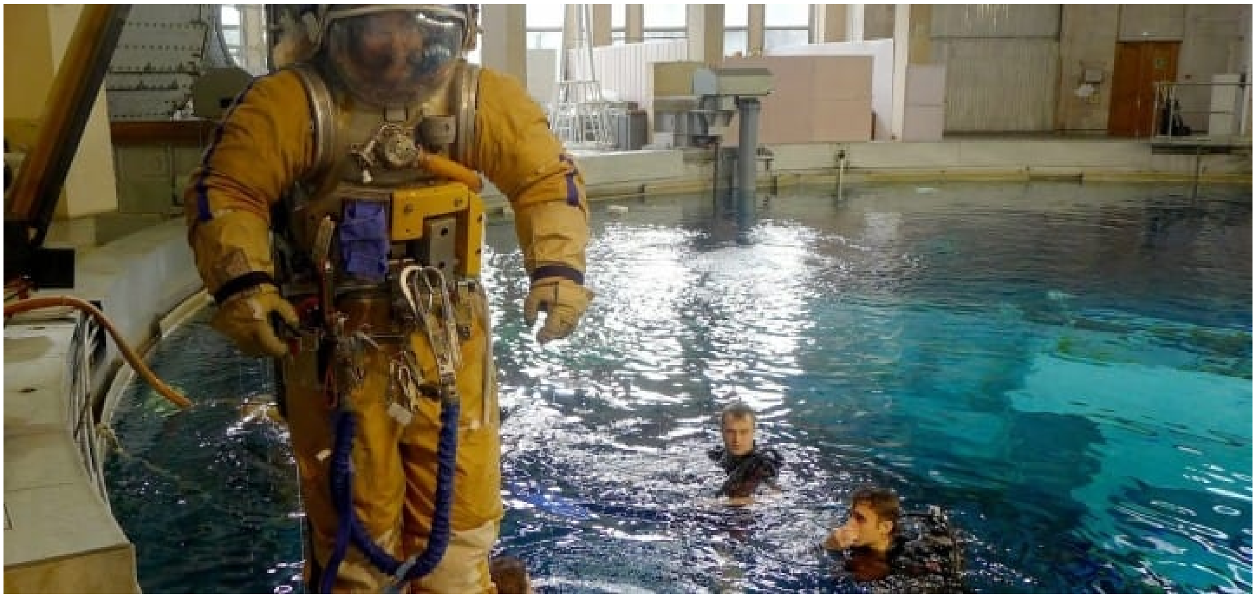
Star City (Moscow, Russia), 2013.09.27—Another great training day in the Orlan today with Sasha. We repeated Wednesday's tasks and of course, after having already seen the profile once, we were much more efficient. We also optimized the tool setup, which helped a lot.

In the picture, taken just after the crane got me out of the water at the end of the run, you can see a peculiarity of the water version of the Orlan. If there was ever a problem with the air supply from the surface, flipping that white lever would switch to the emergency air bottles located in the backup.

The other peculiarity is of course that the front control panel and the computer are missing in the Hydrolab version. The only thing remaining is the analogue pressure gauge (the gray cylindric box), which of course comes in handy in the water as well.

Italian translation of this logbook entry: L-430: La tuta Orlan per l'acqua, *by Paolo Amoroso—AstronautiNEWS.*

L-429



Samantha Cristoforetti in Orlan suit is lowered into the Star City Hydrolab. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.09.28—It's a cold and gray weekend in Star City.

Good time to sit at home with a good cup of tea and jot down some "lessons learned" from last week's training runs in the Hydrolab. I'm not sure when I'll be in the Orlan suit again and I'll be doing so many different things between now and then, that taking notes is vital. Of course, there is standard training material, but you also have to figure out the way of doing things that works best for you. I guess that's valid for a lot of things in life!

The two thick blue tethers with the big hooks you see in the picture are the ones we use to secure ourselves to structure. You move along the handrails "via ferrata" style: take one hook off, attach it to the next handrail, take the other one off… and so on. Of course, never have both on the same handrail, or at least have a standoff in between: the idea is that, if a handrail were ever to come off, you would have the other tether to keep you safe.

Italian translation of this logbook entry: [L-429: La “via ferrata” dello spazio], by Paolo Amoroso—AstronautiNEWS.

L-428

Samantha Cristoforetti enters the Orlan suit for a session at the Star City Hydrolab. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.09.29—I'd like to share some more thoughts about Orlan training.

I've been asked if the Orlan is very different from NASA's EMU suit. I'd say yes. For one thing it is very quick to don: as you can see in the picture, you pretty much climb into the suit, close the "door" behind you and you're ready to pressurize and get into the water.

The other big difference is that it's pressurized at higher pressure, about 1.5 times higher. This gives you a greater margin in case of a leak, but it also reduces dexterity a bit and greater energy is required to work in a more rigid suit.

As in so many other things, it's a balance of different needs!

Italian translation of this logbook entry: L-428: Altre riflessioni sull'addestramento Orlan, by Paolo Amoroso—AstronautiNEWS.

L-427

Samantha Cristoforetti and the crew of the Soyuz TMA-15M in the Star City simulator. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.09.30—Some more briefings today about Russian segment emergency response, in particular about the depressurization scenario.

First big action: calculate how fast the pressure inside the Station is dropping and then figure out how much time you have before you need to evacuate. We call that reserve time.

Second thing: make sure that it's not your Soyuz that is leaking. At least you know that you have a safe ride home.

After that: find the leak and isolate it. We have procedures that lead us through a systematic isolation of portions of the Station: every time we close a hatch we can determine on which side the leak is, until we pinpoint it to one specific module. We can then isolate it and preserve the rest of our pressurized volume.

Now, as you can imagine I am not talking here about movie-style leaks with things and people being drawn out to space. The location of the leak would be quite obvious in that case and you would have different priorities anyway!

After talking Station leaks in the morning, Anton and I had a leak in the engine piping during our afternoon Soyuz sim and as we performed the emergency reentry we got to fight various computer and engine failures… The picture I'm sharing was taken another time though: that day Terry was with us as well and our crew was complete!

Italian translation of this logbook entry: L-427: Perdite alla Stazione e al motore della Sojuz, by Paolo Amoroso—AstronautiNEWS.

L-426

Preparation of the mold for the Soyuz car seat by Samantha Cristoforetti. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.10.01—I'm in there, somewhere!

It takes a village to make the mold for the Soyuz seat liner, as I found out today. A couple of people were pouring liquid plaster on me, a couple more were holding me down so I stayed in good contact with the walls of the "bathtub" and someone was kindly covering my face, so I didn't get plaster splashes on it.

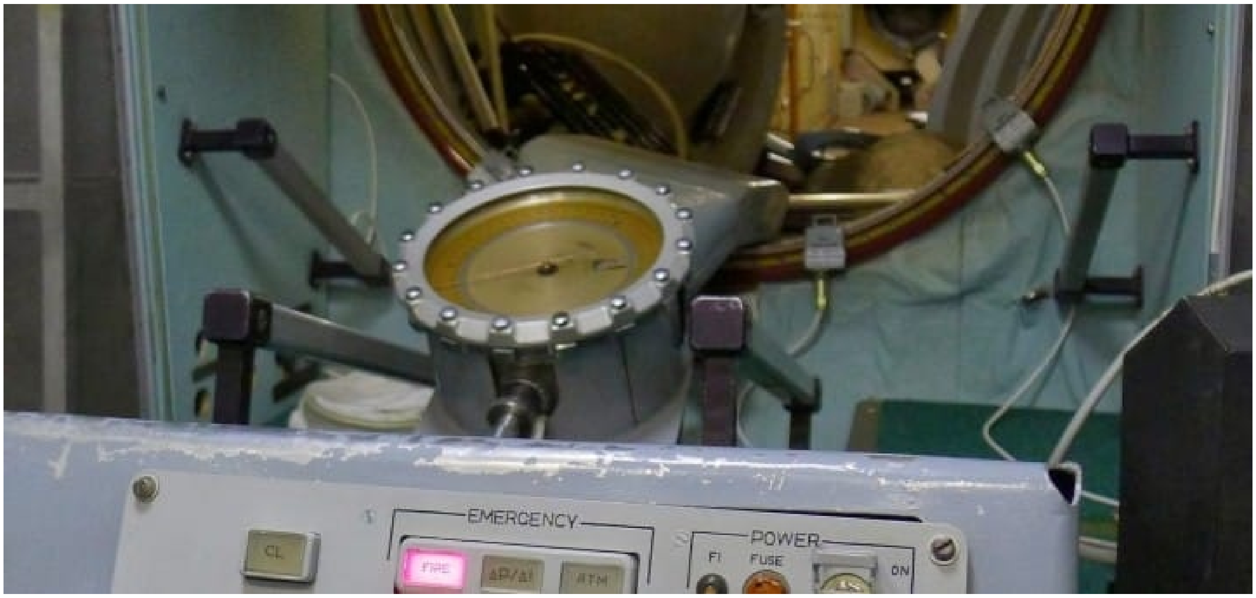
After a first rough mold was done, it took some iterations of adding and scraping away until I was confident that I had no hot spots and had an even contact all along my spine and, most importantly, my neck. A few more iterations in the actual Sokol spacesuit and the mold was done!

The seat liner is especially important at reentry. As you know, there's no such thing as a soft landing in the Soyuz: impact with the ground can be violent. But if the liner fits properly, it will distribute the impact load evenly and prevent injury.

Oh, and yes, days like this do make it feel so real!

Italian translation of this logbook entry: [L-426: La “vasca da bagno” misteriosa], by Paolo Amoroso—AstronautiNEWS.

L-425



Fire simulation in the Zarya FGB module of the ISS. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.10.02—Today I spent a couple of hours in the Soyuz sim practicing manual rendez-vous and docking. Always nice to sit at the controls of the Soyuz and certainly very beneficial to refresh my skills a bit!

In the afternoon I had a long and detailed overview of all the equipment of the Russian segment that might be used in case of an emergency: gas masks and fire extinguishers, of course, but also power switches that you might want to turn off, valves you might want to actuate, hatches you might want to close - and there are several different hatch types in the Russian segment.

Actually, it seems that the crew on ISS is scheduled to do such a review tomorrow: as a basis for my class today we used a Radiogram (a Russian operational message to the crew) with tomorrow's date!

We also went through a couple of scenarios to refresh the knowledge of the procedures. As you can see in the picture, at one point we had a fire in the FGB module.

Italian translation of this logbook entry: L-425: Esaminare l'equipaggiamento d'emergenza, by Paolo Amoroso—AstronautiNEWS.

L-424

Samantha Cristoforetti examines the emergency equipment in the mockup of the Russian segment of the ISS. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.10.03—Today I had an exam about the emergency procedures and equipment on the Russian segment that I have been learning about since last week.

As you might have read, yesterday I had a hardware review class in the mockup. I attach a picture, in which you can see some of that hardware.

For one thing, hatches. There are several different kinds in the Russian segment and it's important to be able to close them quickly in an emergency. Next to every hatch there is always a valve to equalize pressure between the modules and we also need to be able to locate and actuate all of those valves quickly. You can see one on the upper right side of the picture. The modules that can be used as airlock for a spacewalk also have depressurization valves that connect them to the vacuum of space.

At the bottom of the hatch, along the yellow ring, you can also see two air flow sensors. They are installed on all Russian segment hatches and are automatically activated if the "rapid depressurization" alarm goes off. While all the fans are turned off and crewmembers retreat to their Soyuz to leak check their ride home and leave the air circulation unperturbed, within a few minutes the flow sensors might have a resolution for the leak location or point generically to the US segment of the Station.

Oh, I also got to fly the Soyuz for a couple of hours today again. Not a bad day!

Italian translation of this logbook entry: [L-424: Passato l'esame sulle procedure d'emergenza!](), by Paolo Amoroso—AstronautiNEWS.

L-423

Samantha Cristoforetti in the Star City centrifuge in a manual re-entry simulation. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.10.04—Today I got to spend some time with my good old friend, Star City's centrifuge.

Except that it wasn't turning. I really got there pretty much by chance. I was scheduled for a class in manual descent, but the control panel we train on was installed in the centrifuge cabin, because the current prime and backup crews had their manual descent exams this week.

In front of me in the picture is the descent format, that shows the nominal descent curve. The curve starts on top with the moment of entry into the atmosphere and ends at the bottom with parachute deployment. The goal is to get as close as possible to the nominal point of parachute opening, but in our manual control scenarios we're not on the curve to start with: we simulate that there is an error in the time in which we contact the atmosphere, which is typically somewhere between 40 seconds earlier to 40 seconds later.

As an example, if we entered the atmosphere later than planned, we need to dive in steeper to make the parachute deployment point. That can be tricky, because a steeper trajectory means also higher Gs. I guess that's why they make us do the exam in the centrifuge: then we feel the consequence of our control inputs!

Italian translation of this logbook entry: L-423: Ripida ma non troppo, by Paolo Amoroso—AstronautiNEWS.

L-422

Samantha Cristoforetti with the crew of the Soyuz TMA-15M during survival training in water. Source: Samantha Cristoforetti

Cologne (Germany), 2013.10.05—A flashback logbook today, as I am spending a weekend in Cologne and I am taking some time to sort through a mountain of photos from the past months.

This is a picture from last June, when Anton, Terry and myself had our water survival training in a lake not far from Star City.

The most challenging thing about water survival is the heat - in the tiny descent module, the three of us had to doff our Sokol pressure suits (that you see in photo), put on several layers of thermal clothing and a dry suit, before jumping into the water to evacuate a descent module that we simulated to be slowly leaking.

In the confined space, all that changing of clothes took us over an hour and a half in which we were drenched in sweat, taking turns to rest and use the ventilation hoses to cool down. It was fine balance between working fast to get out quicker and working slowly to avoid overheating.

Just in case, before the training we swallowed a wireless sensor via which the doctor could monitor our core temperature during the exercise.

It's unlikely we'll ever have to use these skills, but for sure it was a great exercise in team building!

If you're interested, you can find many more pictures here.

Italian translation of this logbook entry: L-422: Un flashback sulla sopravvivenza in acqua, by Paolo Amoroso—AstronautiNEWS.

L-421

Samantha Cristoforetti in Orlan suit in the Star City Hydrolab. Source: Gagarin cosmonaut training center

Cologne (Germany), 2013.10.06—Unplanned Sunday in Cologne. Due to the temporary "government shutdown" in the US, some non-critical training in Houston has been postponed to a later time, therefore I will leave later in the week. So, instead of being on a plane right now, I'm on my way to see the movie Gravity. Looking forward to that, after having heard so much about it!

Also, I've sorted some more pictures. Here's a set of photos of Orlan training in the Hydrolab in Star City that I hope you will enjoy.

You will notice that there is no jetpack attached to the Orlan suits. That's true on orbit as well. Only NASA's EMU suit has a jetpack, which is called SAFER. And to answer a common question of folks who have seen Gravity: no, we don't fly around using the SAFER.

It has only enough gas to fly you quickly back to structure if you were to become detached from Station. But that's a very unlikely situation and it's never happened before: the regular tether protocols should keep you safe and, if you were to make a mistake, in the EMU we have a safety tether that provides an additional level of protection.

Italian translation of this logbook entry: L-421: No, non svolazziamo con i jetpack nello spazio, by Paolo Amoroso—AstronautiNEWS.

L-420

Luca Parmitano in EVA-22, stopped prematurely due to a water leak in his suit helmet. Source: NASA

Cologne (Germany), 2013.10.07—I took advantage of my unexpected free Sunday and went to see Gravity yesterday.

For what it's worth, I really think you should see it, if you haven't already. A disclaimer here: my knowledge of cinematography is about equal to my knowledge of Sanskrit grammar. But I dare to say that you will inevitably be moved by the aesthetic beauty of the movie, its stunning visuals, its captivating music. I wasn't too much sold on the storyline, but who cares? It's a great excuse to take a trip to space and watch Earth from the orbital perspective. And to visit some of humanity's hardware in space, from the Hubble to the International Space Station to the Soyuz spaceship, all reproduced with painstaking detail down to the labeling of the buttons on the control panel. Go the movie theater, put your 3D glasses and go take a look. Then go out, look up at the sky and think that all those things exists for real, right now, in Earth orbit. Let that thought sink in.

Ok, now to what you really want to know. Yes, the hardware reproduction is amazingly accurate, but how about what actually happens? Is it realistic?

(**Spoiler alert!**)

Well, sorry, no. In my opinion, not a bit. For one thing there's a series of physical impossibilities. Flying from Hubble to ISS on a jetpack? C'mon. They are in completely different orbits: different altitudes, different orbital velocities, different planes. If it's not your daily work, out-of-plane orbital transfers can give you a headache, they're just not intuitive. And they take a lot, really a lot of fuel. Not stuff for a tiny jetpack.

Or let's talk about the drama moment when the brave Commander releases the hook that ties him to his crewmate: it was certainly of great emotional impact to see him floating away under the spell of some magical force, but, ehm, in reality not much would have happened. He would have just kept floating right there.

Anyway, enough said about the physical impossibilities. Let's talk about the things I noticed that in my opinion make no sense from the point of view of real space operations on ISS.

1. **Training** — Dr. Stone said she trained six months for her flight. Well, I have trained for two years and I have one more to go. And, no, I can't even fly a Chinese spacecraft.
2. **Tethers** — During the Hubble repair scenes you see a lot of free-floating tools. In a real spacewalk, nothing is ever left untethered. And crewmembers are additionally attached by a coiling safety tether that would pull them back to structure if they came off.
3. **Jetpack flying** — Crewmembers really don't fly around using a jetpack like that. The jetpack (called SAFER) is just an extra safety measure and has just enough gas to quickly fly back to structure if one was ever to come off.
4. **Loss of communication** — The communication satellites, called TDRS, are geostationary satellites. They are in a 36.000 km orbit. They can't be taken down by debris "flying around" in Low Earth Orbit.
5. **O_2 in the suit running out** — Actually, the first consumable that

would run out would be CO_2 scrubbing. Dr. Stone would have died of CO_2 intoxication well before she'd run out of oxygen.

6. **Airlock hatches** — In the movie Dr. Stone seems to be easily able to "break into" any Space Station that so happens to be in her same orbit by turning a convenient external handle of the airlock hatch. The hatches conveniently open to the outside and the airlocks are conveniently isolated from the rest of the Station. In reality, we don't have external handles on hatches and we don't keep airlocks isolated – if you open the hatch, you depressurize the whole Station. Also, hatches to vacuum open to the inside, not the outside, otherwise they wouldn't be very safe, right? Think of all that inside pressure wanting to push them open all the time. Of course, since they open to the inside you have to depressurize the airlock first, otherwise you would have a very hard time opening them.
7. **Extra ships** — On the various Stations conveniently located on her orbit, Dr. Stone also finds spaceships conveniently left behind by the Station crew. In reality, we have two Soyuz spaceships for six people of ISS. If we have to leave, we use them both. On an evacuated Space Station there would be no Soyuz left behind.

Ok, I'll leave the rest for tomorrow.

In the meantime, go see the movie, bring your friends and tell them all that hardware really exists up there in orbit and it's a magnificent achievement.

Italian translation of this logbook entry: L-420: Alcune riflessioni su GravityL-420: Alcune riflessioni su Gravity, by Paolo Amoroso—AstronautiNEWS.

L-418

The Soyuz TMA-7 leaves the ISS. Source: NASA

Cologne (Germany), 2013.10.09—This is a continuation of Monday's Logbook about the movie Gravity. If you have missed it, please read L-420 Logbook first!

Picking up where I left off, here are some more aspects of the movie that tend towards the fiction side of science fiction. Again, **spoiler alert!**


EXIT

The undersuit with the mesh of cooling tubes. Source: samantha Cristoforetti

8. **Spacewalking** — Spacewalks in the movie are impressive performances worth of a Cirque du Soleil show. Unfortunately that's not very realistic. Actual spacewalking suits are very rigid and have metal joints that constrain movements: range of motion and dexterity are limited and so is one's field of view from inside the helmet. Even with all the extra boost from a big adrenaline rush, sorry, there's just no way you could pull off all those numbers.
9. **Airlock ops** — The ISS airlock that Dr. Stone breaks into is the Russian one, which is used for spacewalks on the Russian segment with the Russian suit Orlan. The airlock is beautifully rendered in amazing detail, so never mind that the blue knob turned by Dr. Stone would not initiate repressurization, that repressurization would anyway take much longer and that getting out of the EMU suit, even with help, takes quite some time. Where I really would like to set the record straight is the underwear department. The tank top and shorts that Dr. Stone is wearing are, well, quite an astonishing fashion statement as far as spacewalks go. In reality, spacewalkers wear very unfashionable, but way more protective, long-sleeved underwear and a cooling undergarment which is a mesh of about 100 meters of tiny tubes (see picture). Water is circulated in those tubes to remove heat from the body and it which is then rejected into space via a sublimator. In the world of real spacewalks, no cooling, no party.
10. **Undocking the Soyuz** — Yes, it is a bit more complicated than just pushing the 'ON' button and sending the undock command. You need to perform leak checks and bring a number of systems online before you can leave. The thought of just jumping into a Soyuz and go was so amusingly grotesque to me that it's one of those moments when I burst out laughing. But, here's a big but: thinking about it some more, I actually think you could do it. I mean, in principle you could show up in your underwear, turn on the control panel, power up the docking system and send the command to open the hooks. As long as the hatch is closed the command would be accepted and

once the hooks open up the spring loaded pushers would give you some separation velocity. I guess if you were really in a hurry, why not? You better have a good plan of what to do next, though, and start turning on vital equipment as soon as you are on your way.

11. **Parachute** — I won't say this too loud, but… you can actually release the parachute from the descent module while comfortably sitting inside. It's standard procedure to release one string after landing to avoid being dragged by the wind. In case of a water landing, you release both strings to avoid being dragged underwater by the parachute weight. That said, doing an improvised spacewalk was certainly more spectacular. But keep in mind that in the actual Soyuz there is no provision whatsoever to do spacewalks and not even a hint of a handrail to translate on. I guess this scene was a tribute to earlier times of the Soviet space program.

Enough for today, to be continued!

Italian translation of this logbook entry: L-418: Altre riflessioni su GravityL-418: Altre riflessioni su Gravity, by Paolo Amoroso—AstronautiNEWS.

L-417

The Soyuz TMA-7 leaves the ISS. Source: NASA

Houston (USA), 2013.10.10—Just arrived in Houston after a long flight in which I had time to jot down some final words on Gravity. Please see yesterday's Logbook L-418 and especially Monday's L-420 for my general thoughts on the movie. The short story is: go see it, it will be a great aesthetic experience and a close encounter with some amazing space hardware that we really operate in orbit. Right now.

As mentioned before, hardware rendering is amazingly realistic, events and operations not as much. Here are some more thoughts on that (**Spoiler Alert!**)

How to remove your Sokol suit. Source: Gagarin Cosmonaut Training Center

12. **Flying a rendezvous** — You're sitting in your tiny Soyuz and want to fly to the International Space Station? That's done four times a year, by the way – every time a new crew is launched to Station. It's called rendezvous and it's technically what Dr. Stone tries to do when she aims at the ISS Tiangong and attempts to fire the Soyuz main engine. Except that it doesn't work that way. Let's say that you are trailing behind the Station. In order to catch up, you need to be in a lower orbit. Here's the trick: every orbit has its own specific orbital velocity. The lower you are, the faster you go. So, if you are on a lower orbit than your target, you catch up: we call that phasing. Then at some point you need to come up to your target's orbit. For that, you'll give two posigrade burns (meaning forward) at two precise moments. That, believe it or not, will end up making you slower. But it will raise your orbit, so you'll have achieved your goals: reach your target and matched its slower velocity. You get the point: even in the simplest possible case that I have just described, a rendezvous involves firing the engine multiple times in burns of extremely precise orientation and duration. No "aim and fire" here!
13. **Can't trick the Soyuz…** — …into thinking that it's 3 meters from the ground. There is no control format to manually input height-above-ground and the soft landing rockets are fired automatically by command of a radar altimeter. Moreover, to expose them not only you would have to separate the Soyuz modules (which they did, I liked that!) but you would also need to detach the heat shield that protects the bottom of the descent module during re-entry. And, you guessed it, that also happens automatically.
14. **Riding the fire extinguisher** — Never mind that we don't have a side hatch in the Soyuz descent module (why would you need one?), but what are the odds of making it to ISS using a fire extinguisher? I remember an old tire ad that said "Power is nothing without control". In this case I would say "Thrust is nothing without control". Let's say you want to move straight backwards. First of all, you need to make sure that you orient your body so that your target is straight behind

you (how?). Then the firing direction of the extinguisher needs to be perfectly aligned with the center of mass of your body/suit system. If it's only slightly misaligned, you will inevitably spin. As soon as you start spinning, your target, that we assumed you were somehow able to put right behind you, will not be behind you any more… start to see a problem here?

15. **Reentry** — When we practice reentry in the Soyuz simulator in Star City there is one thing we need to do no matter what, in spite of the instructors throwing at us combinations of malfunctions worth of, well, a movie: we absolutely have to give a braking burn in the correct orientation and with the required ΔV. In a nutshell that means that we slow down just as much as needed to encounter the atmosphere at the proper angle. Why is that important? Well, that happens to be the key to our getting home in one piece. I'll let you be the judge of whether the apocalypse-day type of scenario depicted in the movie could have ended well for Dr. Stone.
16. **And finally…** — let it be known that the Russians are no fools and certainly no newcomers in the spacefaring business. I guess one could argue that they invented it. This space debris catastrophic cascade reaction is unrealistic as it is. That the Russians, who have three crewmembers on ISS all the time, would cause it, is nonsense!

There were of course many more little things, from the drop of partial oxygen pressure in the descent module without overall drop of pressure to getting out of the Sokol suit under water in a few seconds (it's really not a quick-doff suit, as you can see in the picture), but I'll call this done from my side. Getting back to my own training tomorrow!

Italian translation of this logbook entry: L-417: Riflessioni conclusive su Gravity, by Paolo Amoroso—AstronautiNEWS.

L-416

Samantha Cristoforetti and Terry Virts in a simulation of EVA at the NBL of the JSC in spring 2013. Source: NASA

Johnson Space Center (Houston, USA), 2013.10.11—Back in Houston and straight to the NBL for an extensive preparatory class for my run in the EMU suit next Tuesday.

Terry and I will practice several relatively short tasks, including deploying cables, replacing and relocating an external camera, preparing a nitrogen tank for removal by the robotic arm and replacing an external power converter unit.

I also got to scuba dive in the pool with my instructor Faruq, to get a better overview of worksites and translation paths. The camera worksite on the US Lab is especially challenging, because there are very few handrails to hold on to while working.

Attached is a picture of a previous run with Terry last spring (Credit: NASA).

Italian translation of this logbook entry: [L-416: In piscina per preparare una passeggiata spaziale](), by Paolo Amoroso—AstronautiNEWS.

L-415

Samantha Cristoforetti in the session for the preparation of the seat liner shape near Svesda. Source: Samantha Cristoforetti

Houston (USA), 2013.10.12—I've just finished sorting the pictures from the seat liner molding session I had in Moscow last week.

It took place in the facilities of the company Звезда (Svesda = Star) in the town of Томилино (Tomilino) on the outskirts of Moscow. Звезда has manufactured space suits and seat liners since the very beginning of human spaceflight, so it might happen that you find yourself on a scale that has been used to weigh cosmonauts since 1961!

You can see pictures of the whole process here.

Based on the mold and the measurements they took, the good folks at Звезда will manufacture for me Sokol suit n. 422 and seat liner n. 650. I did ask the question: why don't the numbers match? It seems that the numbering of the seat liners was fast-forwarded to 500 at some point to mark the introduction of a new model.

I'll be back at some point in the coming months to try the suit in the vacuum chamber.

Italian translation of this logbook entry: [L-415: In attesa della tuta Sokol numero 422](), by Paolo Amoroso—AstronautiNEWS.

L-414

Sunita Williams on the ISS treadmill. Source: NASA

Houston (USA), 2013.10.13—Besides Sokol suits and seat liners, as explained in yesterday's Logbook, ISS crewmembers also get custom fitting ear plugs. On Friday I was scheduled for a final fit check, where I could wear them for some time while I worked on my computer to make sure that they are comfortable.

There is a simpler passive version and an active version that we use to take our periodic hearing assessment on ISS. As you might know, Station is pretty loud, mainly because of the significant number of fans that run continuously to force air circulation, thus providing mixing of atmosphere component, smoke detection capability and, in some cases, cooling of equipment.

Another very loud piece of machinery is the T2 treadmill, especially if you are a fast runner like Suni, whom you can see in the picture. I'm not a fast runner at all, but I'll still make sure to wear ear protection on T2 as recommended by our flight surgeons.

(Photo credit: NASA/Stafford - Image: jsc2012e238218)

Italian translation of this logbook entry: [L-414: Lo spazio è silenzioso ma la ISS è rumorosa](), by Paolo Amoroso—AstronautiNEWS.

L-413

Terry Virts works at the UIA panel in the airlock mockup for the ISS EMU suits. Source: NASA/Stafford - Photo: jsc2012e238218

Johnson Space Center (Houston, USA), 2013.10.14—Today is Columbus Day, a national holiday in the US. I'm doing some work to get ready for tomorrow's underwater training in the NBL with crewmate Terry (see L-416 Logbook).

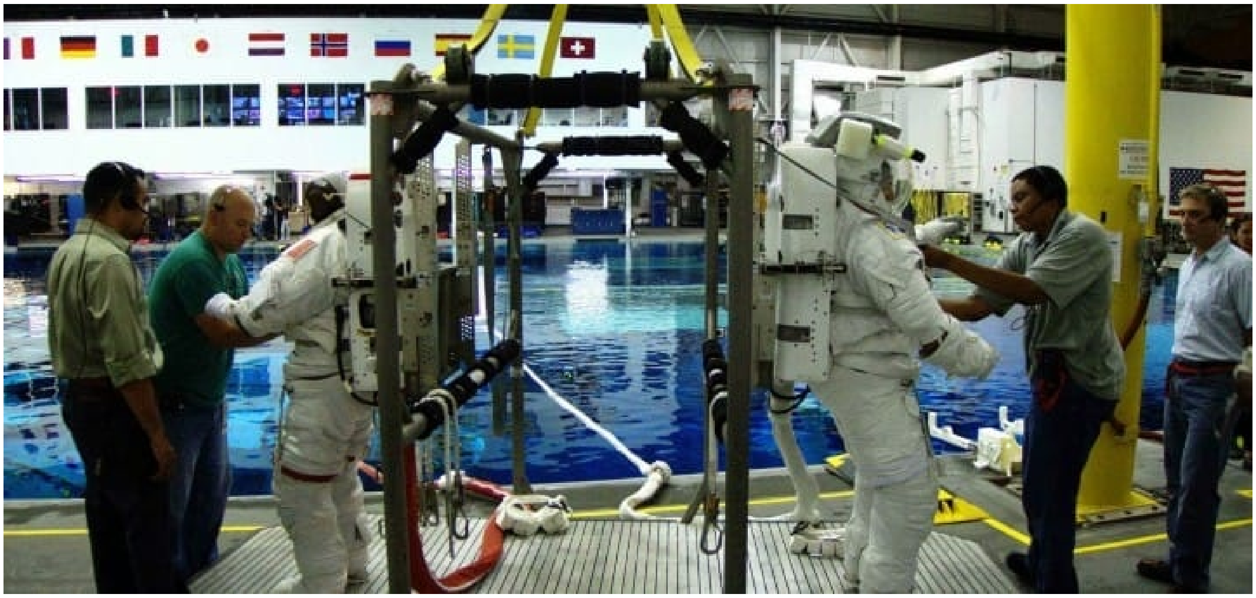
Most training runs in the NBL start in the airlock, which is of course where real spacewalks start. In the airlock we have a panel called UIA (Umbilical Interface Assembly) that acts as interface between the Station and the EMU suits providing power, oxygen and water. We don't have a functioning UIA underwater of course, but we do have a passive mockup and periodically we go through the depressurization and repressurization checklist to familiarize ourselves with the motions.

Most of airlock operations we practice in a "dry" airlock mockup: in the picture you can see Terry working on the UIA during a training event.

Photo Credit: NASA

Italian translation of this logbook entry: [L-413: Operazioni nell'airlock](), by Paolo Amoroso—AstronautiNEWS.

L-412



Samantha Cristoforetti and Terry Virts in an EVA training session at the JBL's NBL. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.10.15—Just got back from the Neutral Buoyancy Facility after another intense spacewalking training day underwater with Terry.

Training in the EMU suit always involves a very long day. As crewmembers, we show up around 6:30 am on the pooldeck to set up out tools and we get done with the debrief around 5 pm. But there are people who show up a lot earlier in the morning to make sure that the facility, the suits, the tools, the com and life support equipment are ready to support our training and keep us safe underwater.

The professionalism and dedication of the NBL team never ceases to amaze me!

Italian translation of this logbook entry: L-412: Una giornata sott'acqua al Neutral Buoyancy Laboratory, by Paolo Amoroso—AstronautiNEWS.

L-411

Terry Virts on the APFR and Samantha Cristoforetti in an EVA simulated at NBL. Source: NASA

Johnson Space Center (Houston, USA), 2013.10.16—One of the tools we worked with yesterday in the pool with Terry is the APFR - Articulating Portable Foot Restraint.

You can take a look at one in the picture I attached. As you can see, you can slide your boots in there: it takes a deliberate rotation of the heels to make or release the connection, so once you're in you have a rigid attachment point to structure. That's really useful when you need to work for a long time at a worksite, especially if the worksite doesn't provide a lot of handrails or if you need to react big loads (like releasing a bolt that was fastened at a high torque).

APFRs have three articulating joints to adjust pitch, roll and yaw. They are attached to structures via WIFs, which are available on structure throughout Station. The clocking of the APFR in the WIF (how it is rotated with respect to a reference line) gives you an extra adjustment opportunity for the orientation.

And of course when a crewmember needs to work on the robotic arm we can attach an APFR on the arm end effector.

Italian translation of this logbook entry: L-411: Ancorati al braccio robotico, by Paolo Amoroso—AstronautiNEWS.

L-410

Samantha Cristoforetti is trained in the maintenance of the T2 treadmill at the JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.10.17—Back to a busy training schedule today, from training on the ARED (Advanced Resistive Exercise Device) to a class on setting up onboard cameras and video downlinks from the Space Station to a refresher of power and thermal control systems, which including running an external ammonia leak scenario to review some critical procedures.

But the day started at the ground training model of the T2 treadmill, on which ISS crewmembers are scheduled to run several times a week for their cardiovascular conditioning. Running on the treadmill generates significant loads and, as you can imagine, we don't want those loads to be transmitted to the rest of Station. For this reason the treadmill is actually "suspended" on a vibration isolation system, that dampens out the loads imparted by the running crewmember. To make sure this works satisfactorily, periodically we perform an alignment procedure, which is what I was learning to do in the photo.

If you missed it and you're curious to see how we can run in weightlessness, take a look at Logbook L-414.

Italian translation of this logbook entry: L-410: Allineare il tapis roulant della ISS, by Paolo Amoroso—AstronautiNEWS.

L-409

Samantha Cristoforetti shows a pair of EMU Class 1 suit gloves in a glovebox. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.10.18—Today I spent the morning at the off-site facilities in which Class 1 EVA suits are produced.

The designation "Class 1" means that a piece of hardware is meant to fly to space, as opposed to being used on the ground, for example for training. Today I got to try on Class 1 EVA gloves and to make all the necessary adjustments to have the best possible fit.

Of course we need to try the gloves in their pressurized state, because the overpressure changes the fit completely. Mainly, as you would expect, it inflates the gloves, making them larger. For that purpose we have a dedicated glovebox: when you insert the hands, the rings on the arm seal the volume and air can be pumped out until we get the necessary overpressure of 4.3 PSI in the gloves.

The fitting process is an iterative one involving a lot of patient work by the suit technicians. You put the gloves on, insert the arms in the glovebox, pressurize, see how it feels, discuss the fit with the suit engineer, make the changes that sounds reasonable and try again. Repeat as many times as necessary.

Pretty exciting to work with gloves that will actually fly to space for me!

Italian translation of this logbook entry: L-409: Lavorare con guanti che voleranno nello spazio, by Paolo Amoroso—AstronautiNEWS.

L-407

Samantha Cristoforetti trains to reconfigure a cooling water circuit in the ISS mockup at the JSC. Source: Samantha Cristoforetti

Houston (USA), 2013.10.20—Among several other classes, on Friday I had a review of the Internal Thermal Control System, in preparation of a water leak scenario that I will work on with the rest of the crew in the upcoming weeks.

Water is the medium with which excess heat is collected on ISS, either via cold plates on which equipment is mounted or via the air conditioning assemblies.

If a drop in water quantity in the cooling loop detected, the crew will be asked to try and pinpoint the leak. Unless there is an obvious loss of water into the cabin, finding a leak involves disconnecting one by one the various racks from the water lines so see if removing that rack from the loop stops the decrease of water quantity in the system… in which case we would have found the culprit!

At some point, though, if enough water is lost, that cooling loop will be shut down. Fortunately we have two cooling loops and we are able to ensure cooling to at least some critical hardware by "jumpering", meaning inserting critical racks on the water lines of the healthy loop.

That involves a lot of manual reconfigurations, as you can see in the picture!

Italian translation of this logbook entry: L-407: A caccia di perdite d'acqua, by Paolo Amoroso—AstronautiNEWS.

L-406

Samantha Cristoforetti in a low-fidelity simulator from the ISS Destiny laboratory at the JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.10.21—Just had an interesting review class on the Command and Data Handling system of the Space Station.

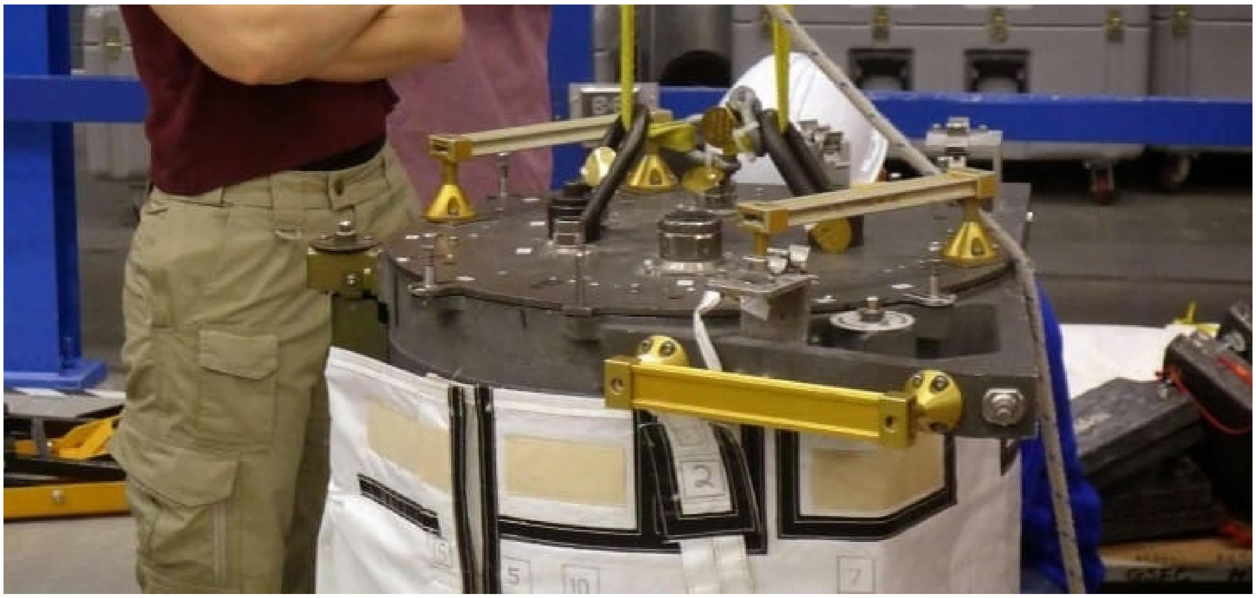
In particular, we focused on the consequences of C&C MDM transitions: those are the computers that control the ISS, meaning that the are at the top of the computer hierarchy.

Pretty important, as you can imagine: that's why we have three, just in case. Depending on how many we loose and how functionality is recovered, there might be a need to reconfigure the com system to recover space-to-ground audio capability and talk to mission control.

So, that's what I practiced today. The facility you see in the picture is a simulator of the US lab. Physically it's not very high-fidelity - there are other higher-fidelity mockups - but brain-wise it functions just like the Station.

Italian translation of this logbook entry: [L-406: Se i computer principali si guastano…](), by Paolo Amoroso—AstronautiNEWS.

L-405



Samantha Cristoforetti examines a high-fidelity replica of a component of the ISS solar panels at the JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.10.22—Today Terry, Butch and I had a familiarization class with high-fidelity EVA hardware.

When we practice spacewalks in the pool we have replicas of the components we need to repair or replace. These replicas have most of the elements that we work on: bolts, electrical connectors, fluid lines, etc… but in the pool environment not all features can be replicated.

Today, in a dry environment, we had a chance to put our eyes and hands on high-fidelity equipment! The piece of hardware you see in the picture, for example, provides rotation capability of a single solar array wing around its axis. This way we can always optimize the orientation of the array with respect to the Sun and maximize the energy generation.

Italian translation of this logbook entry: L-405: Mettere gli occhi e le mani sulle vere attrezzature, by Paolo Amoroso—AstronautiNEWS.

L-404

Samantha Cristoforetti, Anton Shkaplerov and Terry Virts at an ISS attitude control simulation at the JSC. Source: Josh Matthew

Johnson Space Center (Houston, USA), 2013.10.23—Today Anton, Terry and I had our first training event together in Houston as the Soyuz 41S crew. The occasion was a simulation in which we had to deal with a Loss of Attitude Control on ISS. We call that LOAC for short.

If you think about it, that's pretty bad. We need to have the Space Station in a known, controllable attitude in order to make sure that we have good pointing for the antennas, the solar arrays, the radiators, etc.. without attitude control the Station will continue spinning with whatever (little or big) rotation rate it had when attitude control was lost.

Both the US Lab and the Russian segment Guidance and Navigation Computers can provide attitude control, with one big difference: the US segment has Control Moment Gyroscopes, the Russian segment has actual thrusters. In one of our scenarios today the Control Moment Gyroscopes saturated and that caused the LOAC. To recover from that, we had to transfer control of the Station to the Russian segment, so that attitude control could be reestablished with the help of the thrusters.

However, thrusters impulses can be significant and they could potentially damage the huge solar arrays that provide power to the Station. That's why we first need to bring the solar arrays to a safe angle and lock them there. Only then can we safely go to thrusters control.

Thanks Josh Matthew for the photo!

Italian translation of this logbook entry: L-404: Se perdete il controllo d'assetto della stazione…, by Paolo Amoroso—AstronautiNEWS.

L-403

Samantha Cristoforetti replaces the toilet's solid waste container in the ISS mockup at the JSC. Source: NASA/Harnett

Johnson Space Center (Houston, USA), 2013.10.24—If you've been following this logbook, you'll know by now that in training we spend a lot of time preparing for emergencies and contingencies of all kinds.

It's vital to have the knowledge and skills necessary to resolve a contingency situation, but of course we have a reasonable expectation that most of our time on orbit we will be working nominal operations.

To prepare us for that, the training community organizes periodically so called routine-ops simulations. In such sims we spend about five hours in the ISS mockups and we run through a typical timeline, starting with the morning Daily Planning Conference (DPC). That's a tagup of the crew with all the control centers, starting with Houston, then on to Huntsville, Munich, Tsukuba and finally Moscow. At the end of the day there is a similar evening DPC to wrap up the day's work.

This afternoon Terry, Anton and I will have such a routine ops sim. My last one was back in May. As you can see in the picture, that time Butch and I got to practice some routine work on the toilet, namely replacing the solid waste container. That's definitely something we'll do for sure on orbit.

Photo credit: NASA/Harnett

Italian translation of this logbook entry: L-403: Operazioni di routine, anche con la toilette, by Paolo Amoroso—AstronautiNEWS.

L-402

Samantha Cristoforetti trains at the Material Science Laboratory in the ISS mockup at the JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.10.25—Started the day with a sim with Butch and Terry on rendez-vous operations for vehicles like Dragon, HTV or Cygnus. Now off to a class on ARED maintenance: that's the Advanced Resistive Exercise Device with which we simulate weight-lifting on orbit.

In between I had an overview class of the Material Science Laboratory payload. The core of this facility is a high-temperature furnace, which is placed inside a vacuum chamber. In the picture you can see me practicing the changeout of a sample cartridge.

Italian translation of this logbook entry: L-402: Lavorare con il Material Science Laboratory, by Paolo Amoroso—AstronautiNEWS.

L-401

Samantha Cristoforetti trains to apply lubricant to the end of the ISS robotic arm. Source: Samantha Cristoforetti

Houston (USA), 2013.10.26—One of the training events I had last week was a familiarization class with high-fidelity EVA hardware (see Logbook L-405).

Among many other things, we had a chance to practice applying lubricant to the snares of the robotic end effector. You can check out this older Logbook for some pictures of the actual end effector and target pins in space.

When we squeeze the trigger to capture the target pin, it's important that the snares rotate freely at their attachment points when they close. And so periodically spacewalkers need to take a grease gun out and apply some lubricant to the snare bearings themselves.

Italian translation of this logbook entry: L-401: Quando il braccio robotico ha bisogno del lubrificante, by Paolo Amoroso—AstronautiNEWS.

L-400

Samantha Cristoforetti examines the ISS toolbox at the JSC. Source: NASA

Houston (USA), 2013.10.27—This past Thursday Anton, Terry and I had a five-hour Routing Ops Sim in the ISS mockups (see Logbook L-403).

Anything that is not science and is not a contingency situation is a good candidate for these simulations, including of course maintenance activities. As you can imagine, the Station is a complex machine that requires some care. The ground keeps track of preventive maintenance requirements on every piece of equipment and schedules the necessary tasks when they're are due. Of course, once in a while something does break and in that case a corrective maintenance activity will be scheduled.

To save crew time, the ground will try to take care as much as possible of all the steps that can be performed remotely. For example, the first steps of a procedures will often contain actions like opening an electric switch or commanding a valve in a particular position to put the equipment in a safe configuration for hands-on work. Since the specialists sitting on console at Mission Control can also send those commands, it's not unusual for the crew to receive a call that they are "Go" to start with a later step in the procedure.

Of course, only the crew can put hands on the equipment. And for all those hands-on activities, as you can see in the picture, we have a tool-box that would make any DIY enthusiast envious!

You can see some more pictures of our May routine ops sim.

Photo credit: NASA

Italian translation of this logbook entry: L-400: La più straordinaria cassetta degli attrezzi, by Paolo Amoroso—AstronautiNEWS.

L-398

Samantha Cristoforetti in EMU suit is lowered into the NBL for an EVA simulation. Source: NASA/Stafford

Johnson Space Center (Houston, USA), 2013.10.29—Really busy start of the week! Lots of classes today, from the Spheres payload (ZeroRobotics anyone?) to a refresher class on robotic support to EVA - that's when we use the Canadarm2 to "fly" spacewalkers or large components from one place to another around Station.

I also had a class on EVA suit malfunctions, practicing what you do when you get an alarm message on your computer display, accompanied by an alarm sound in your headset. As you can see in the picture, we carry a small booklet attached to the left arm, which we call cuff checklist. This checklist contains the response actions to be taken in case we receive one of those alarms. For example, it helps us clarify whether the signature we get corresponds to a real problem with the suit or a sensor malfunction. And in case of a real problem, the checklist contains guidance on whether to terminate or abort an EVA, the second case being more serious and requiring an immediate return to the airlock for both crewmembers.

The picture is from yesterday, by the way, when I had a training session in the pool with my Expedition 43 crewmate and 1-year crewmember Scott Kelly.

Photo Credit: NASA/Stafford

Italian translation of this logbook entry: L-398: In caso di malfunzionamento della tuta per EVA, by Paolo Amoroso—AstronautiNEWS.

L-397

Samantha Cristoforetti on the POGO weightlessness simulator at JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.10.30—Today I had my first encounter with the POGO - the Partial Gravity Simulator here at Johnson Space Center.

Simulating weightlessness in training is not easy and all the different ways we use have their pros and cons. Of course, we can not just switch off gravity. And we don't know of any way of shielding the gravitational field, like we can do with the electromagnetic field. So, we're stuck with it.

In parabolic flights we can have about 22 seconds of free fall inside the airplane cabin and we typically repeat that for about 30 parabolas per flight. As far as a human being is concerned, that's true weightlessness, since we can not perceive the residual acceleration that does exist. However, those 22 seconds are very limiting when you're trying to train complex tasks.

As you know, we train for spacewalks under water by establishing neutral buoyancy of the pressure suit. In many ways, training under water can be harder than working on orbit, because the suit can not be neutral with respect to rotation on all axes and because every time we move we have to displace the water. However, water can also make some things easier because of its stabilization effect.

Let's say that you're driving a bolt. When you reach the hard stop you need to be able to react the torque you're applying by having a solid attachment point to structure, otherwise you'll go spinning the other way. But it's hard to feel that full effect in the pool because of the stabilization effect of the water.

So here's where the POGO (Partial Gravity Simulator) comes in. The suspension system compensates the body weight so that we can move up and down, rotate and, to a degree, move in the horizontal plane in conditions similar to actual weightlessness.

Italian translation of this logbook entry: L-397: È l'ora del POGO! Come simuliamo l'assenza di peso, by Paolo Amoroso—AstronautiNEWS.

L-396

Samantha Cristoforetti performs a blood test in training at the JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.10.31—Learned how to draw blood today… doesn't it suit Halloween somehow?

As you know, the International Space Station is a laboratory where we do research in microgravity conditions. Crewmembers are important test subjects for human physiology investigators who attempt to better understand how the human body works by observing the way it adapts to the space environment.

Blood of course contains important biochemical markers of that adaptation. That's why periodically we are all scheduled for blood draws: how often and how many tubes we draw depends on the actual experimental program for which we are subjects.

Blood-filled tubes are then stored in the Melfi freezer and returned to Earth at the first suitable download opportunity.

Italian translation of this logbook entry: [L-396: Imparare a prelevare il sangue… ad Halloween](), by Paolo Amoroso—AstronautiNEWS.

L-395

Dave Williams in an STA-118 EVA for replacing an ISS CMG. Source: NASA

Johnson Space Center (Houston, USA), 2013.11.01—I've spent the day so far at the Neutral Buoyancy Laboratory to prepare a training run in the pool I'll have next Friday with veteran spacewalker Peggy Whitson.

First we had the so-called 1G class, where we were introduced to the hardware and the procedures. And then I had a chance to dive in the pool to take a look at worksites and translation paths.

We will replace two components: the S-Band antenna (SASA) and one the four Control Moment Gyroscopes (CMG). The CMGs are pretty massive: in the picture you can see astronaut Dave Williams holding one during a STS-118 spacewalk, when a failed ISS CMG was replaced.

Photo credit: NASA

Italian translation of this logbook entry: L-395: I Control Moment Gyroscopes, by Paolo Amoroso—AstronautiNEWS.

L-394

Samantha Cristoforetti is lowered into the NBL for an EVA simulation session. Source: Samantha Cristoforetti

Houston (USA), 2013.11.02—This last week I spent quite a bit of time at the Neutral Buoyancy Facility. The picture I'm sharing is from last week's suited run with crew-mate Scott Kelly.

As you can see in the photo, as soon as we are lowered into the water at the beginning of a training day, the safety divers take charge of us. Before we start our six hours of hard work, it's time for their show!

First they give a shake to the suit to get rid of the air bubbles that might be trapped in the folds of the external garment. After that, any remaining stream of air bubbles would indicate a leak of the suit, so this is a good time for a final check. After a go from the suit engineer who's watching from the pool deck, the divers take us to the bottom of the pool to do our initial weigh-out.

The purpose of the weigh-out is to make sure we're neutrally buoyant in the water. In the first place, of course, that we don't have a tendency to rise or fall. And then there is rotation. While we run our communication checks and we listen to the safety briefs, the divers spin us around in all directions to detect any tendencies of the suit to rotate along its axis. To neutralize those tendencies, they can insert small blocs of weights or foam of different densities into dedicated pouches located around the legs, on the backpack and on the chest area.

It's an art, rather than a science. And adjustments are needed throughout the run to compensate for changes in configuration, water depth at in which we are working and the tendency of the suit to expand after several hours in the water.

Credit: NASA/Stafford

Italian translation of this logbook entry: L-394: Come raggiungere l'assenza di peso in acqua, by Paolo Amoroso—AstronautiNEWS.

L-393

Samantha Cristoforetti arranges the blue valve of the water bag in the EMU suit in a session at the NBL. Source: NASA/Stafford

Houston (USA), 2013.11.03—You might have wondered if crewmembers have something to eat or drink during spacewalks, that can easily last 7-8 hours.

I have heard that some kind of food bars were available in the suit in the past, but experience has shown that they were more a nuisance than a help. In terms of energy, it's easier to rely on a big breakfast.

There is a water bag in the suit, though. We also use it in the pool for our 6-hours runs. It's a disposable rubber bladder that contains up to 32 oz (almost 1 liter) of simple water. When we arrive on the pool deck in the morning after the brief, the first thing we do is to insert that bladder into a reusable restraint bag and to orient the blue bit valve the way we like to have inside the helmet.

Preparation for a session in the NBL pool. Source: NASA/Stafford

We then secure the bag inside the suit with velcro, making sure that the bite valve is at the proper height for easy reach. Just like the water bags commonly used by bikers and hikers, you need bite on the valve to open the orifice and draw water from the bag. Once you release it, the orifice closes to prevent more water from flowing out.

Photo credit: NASA/Stafford

Italian translation of this logbook entry: L-393: Niente cibo nelle passeggiate spaziali, solo un po' d'acqua, by Paolo Amoroso—AstronautiNEWS.

L-392

C-tracks in an ISS mockup at the JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.11.04—After some "cultural training" last night organized by crewmate Terry, who took Anton and me to the Houston Texans football game and was patient enough to explain the rules to us, the training week has started full speed this morning with a pretty long sim in which we practiced recovery from a major power failure: one of those nasty situations in which you loose com with mission control and, as a crew, you need to dig into long and convoluted procedures to bring the Station to a safe configuration.

Later in the day, on to some preparation work with Peggy for our EVA training run on Friday and then a review of habitation aspects on Station. That includes obvious things like crew quarters, housekeeping tasks, food, …but also some fun little details, like all the different devices that we can use to position and secure things on orbit.

Most of the racks on Station have so called C-tracks seat tracks: in the picture you can see two such tracks running top to bottom next to each other in the ISS mockup. And you can also see some of the devices that we can secure at any point on a C-track seat track and can in turn be used to mount and orient laptops, foot restraints, cameras, extra lights and more.

Little tricks about living on humanity's outpost in space.

Italian translation of this logbook entry: [L-392: Piccoli trucchi del vivere nello spazio](), by Paolo Amoroso—AstronautiNEWS.

L-391

Samantha Cristoforetti and Terry Virts in the ISS mockup at the JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.11.05—Really full day at the airlock mockup. It's a Prep & Post day for me and Terry: a spacewalk day, minus the actual spacewalk.

If you missed it, take a look at the L-470 Logbook for more info about a Prep & Post class.

That time I was the IV crewmember, meaning that I was the "inside" support person. Today, Terry and I will actually be in the suit. We had some briefs and practice this morning about preparing the airlock and the suits and in a few minutes, after a very early lunch break, we'll get into our thermal cooling undergarments to start the suiting up and pre-breath protocols.

Italian translation of this logbook entry: L-391: Una giornata Pre & Post, by Paolo Amoroso—AstronautiNEWS.

L-390

Samantha Cristoforetti and Terry Virts in the airlock mockup for a simulation of pre & post EVA procedures. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.11.06—As mentioned in yesterday's logbook, Terry and I spent the day in the airlock mockup to rehearse pre- and post-EVA procedures.

The most important topic of the day was the pre-breath protocol. Before depressing the airlock to vacuum and opening the hatch to go on a spacewalk, we need to pre-breath pure oxygen to purge nitrogen from our bloodstream and prevent decompression sickness symptoms while out on an EVA. Yes, it's the same problem that divers might have when they resurface: going from a higher pressure to a lower one. The suit, in fact, is only pressurized to about a third of atmospheric pressure: otherwise it would be too rigid and it would be impossible to do complex work in it.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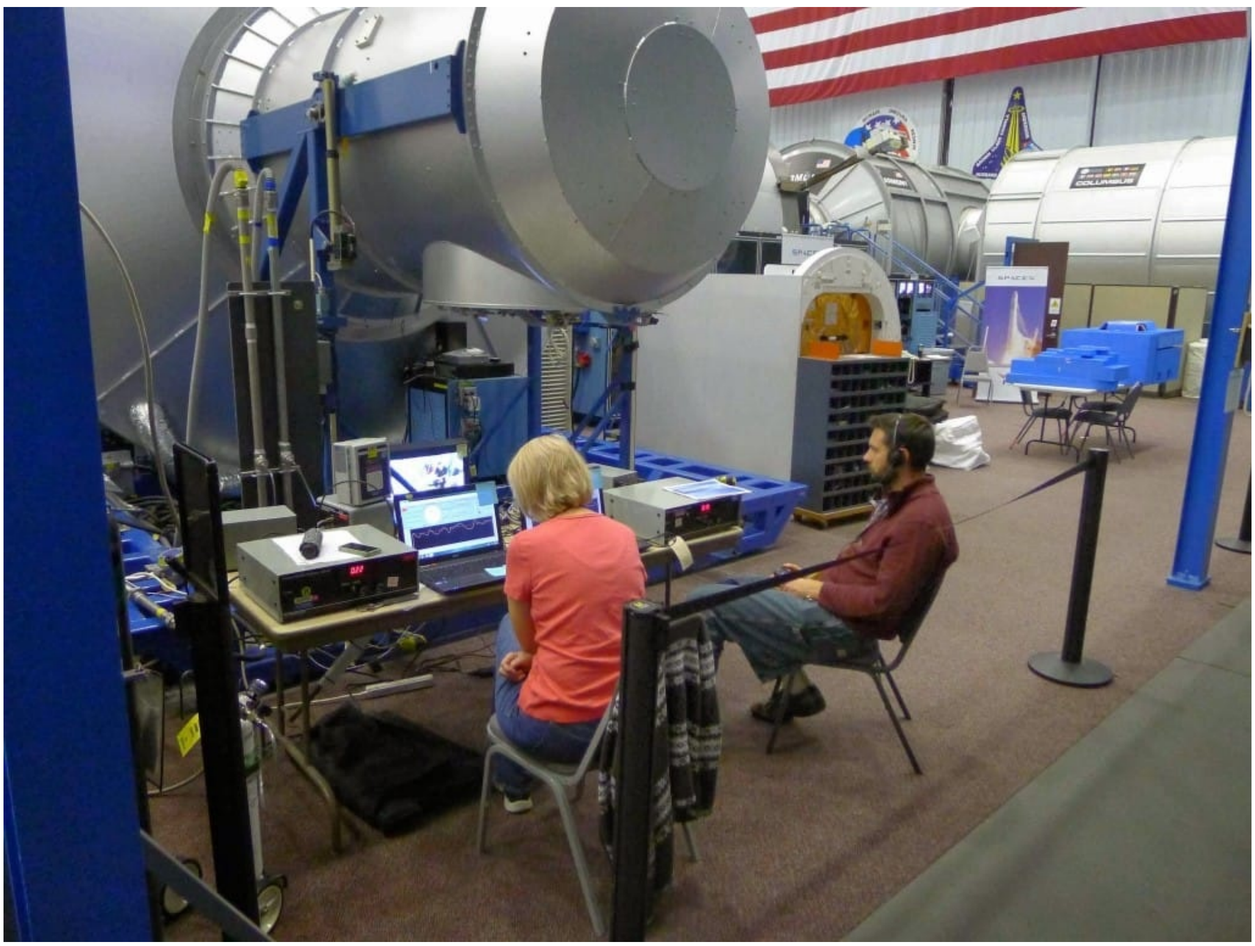
Medical equipment for the control of a pre & post EVA simulation. Source: Samantha Cristoforetti

There are different pre-breath protocols. The one that is commonly used now is the In-Suit Light Exercise. After breathing pure-oxygen through a mask for about an hour while performing initial preparatory work, EVA crewmembers don the suits, purge them for a few minutes to get a pure oxygen atmosphere inside and then do little movements with arms and legs for about 50 minutes. That increases the metabolic rate slightly and speeds up the nitrogen purging.



Medical staff follow a pre & post EVA simulation. Source: Samantha Cristoforetti

One of the goals of yesterday's Prep & Post class was for Terry and me to understand how intense (or actually little intense) that in-suit exercise has to be to hit the target metabolic rate. Medical personnel gave us feedback real-time based on our CO_2 production so that we could adjust the intensity of the work and, hopefully, develop some memory for the ideal level of exertion that is required.

Italian translation of this logbook entry: L-390: Il protocollo di prebreathing, by Paolo Amoroso—AstronautiNEWS.

L-389

Houston, texas-Samantha Cristoforetti Astronaut of the European Space Agency (ESA), together with the US astronaut Mark Vande, in the reproduction of the International Space Station, during a phase of his training at the NASA Johnson Space Center which foresees the management of scenarios emergency, in this case fire, which could occur on the ISS space station during its future space mission. Source: © Milo Sciaky

Johnson Space Center (Houston, USA), 2013.11.07—Today Terry, Anton and I had a 5-hour sim in which we practiced emergency responses: fire cases, depressurization scenarios and an instance of the dreaded ammonia leak.

For this occasion I thought I'd reshare this older post (below) from way before the Logbook time. And if you really want to know more about fire on ISS, you can also take a look at this blog post.

In a few minutes the three of us will be back in the mockups for another type of emergency training. We call it Megacode and it's a chance to practice our response in case of life-threatening medical conditions like a cardiac arrest.

Earth’s safest workplace is off the planet… most of the time

Seriously, from the point of view of occupational safety, the International Space Station is pretty hard to beat. Not only you cannot possibly fall from a ladder in space, but it’s also very unlikely you will get an electric shock. You will hardly find any sharp objects to cut yourself with or exposed surfaces hot enough to burn you and all toxic material is isolated from the Station’s atmosphere by multiple layers of containment. The rare flammable objects present on-board are dutifully stowed in non-flammable Nomex pouches. If your activity exposes you to any hazard, big warning blocs in your procedure will remind you of the proper steps to be taken to ensure you don’t get hurt. Safety teams on the ground review those procedures as well as all equipment and they go out of their way to make sure the ISS is as safe a workplace as it can possibly be.

And it makes a lot of sense to make this effort! We can only provide limited medical care to the crew on orbit and it would be a huge deal to return an injured crewmember to Earth – in fact, most likely the entire Soyuz crew, three people out of six, would have to return.

Still, as safe as the Station is, things can still go wrong and most of our training as crewmembers is aimed at teaching us how to deal with problems. We need to know what to do when equipment breaks and some of us are also trained to provide basic medical assistance to a crewmate in case of an accident. Most of all we need to be able to react quickly and to work efficiently as a crew if one day one of three dreaded lights on the Caution and Warning Panels installed throughout Station light up, accompanied by a well-known intermittent siren: the emergency tone.

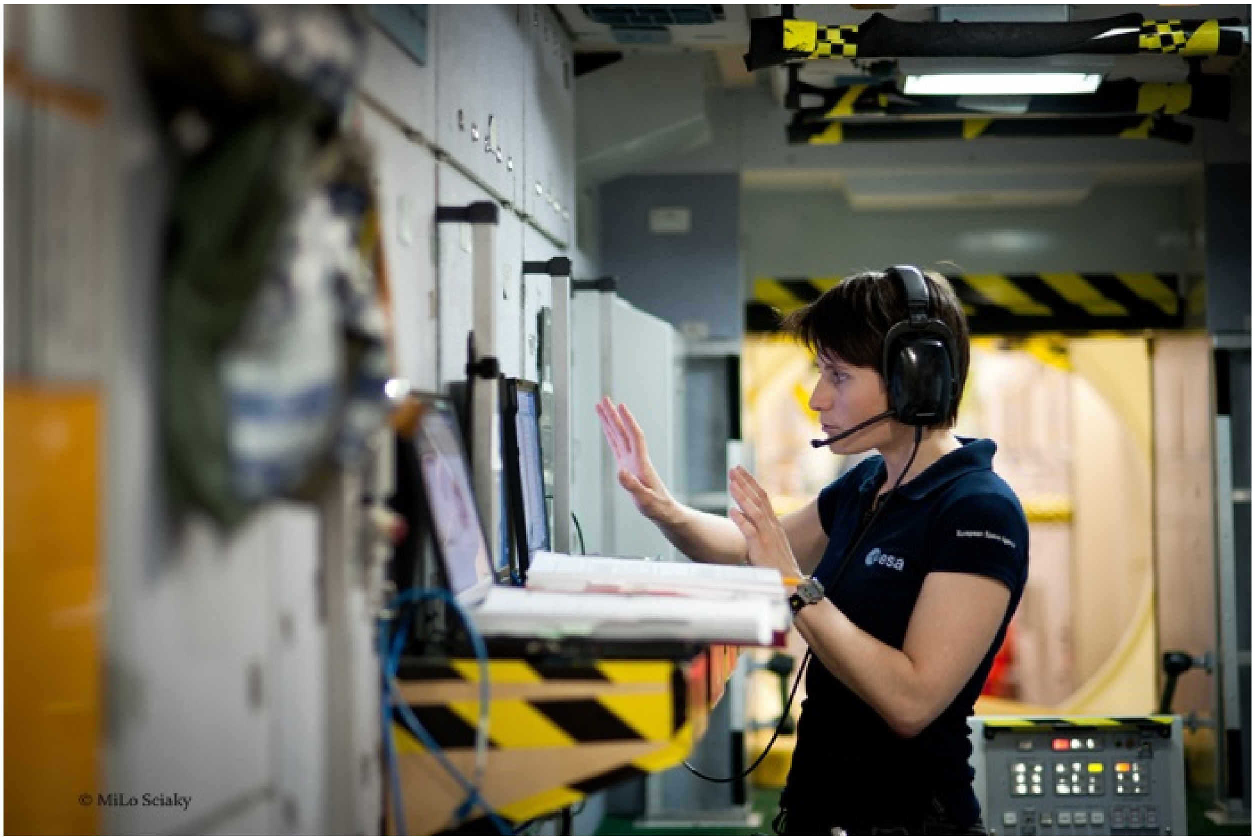
Each light is associated with one of three very serious situations, that can endanger the life of the crew and the survival of the Station itself: fire, rapid depressurization and toxic atmosphere. We get extensive training on this and no crew goes to orbit without having demonstrated proficiency in emergency response in multiple simulations.

I participated in several such simulations last year and I'd like to share some pictures of a fire scenario with you. More details are in the captions. Pictures are courtesy of Milan-based photographer Milo Sciaky.

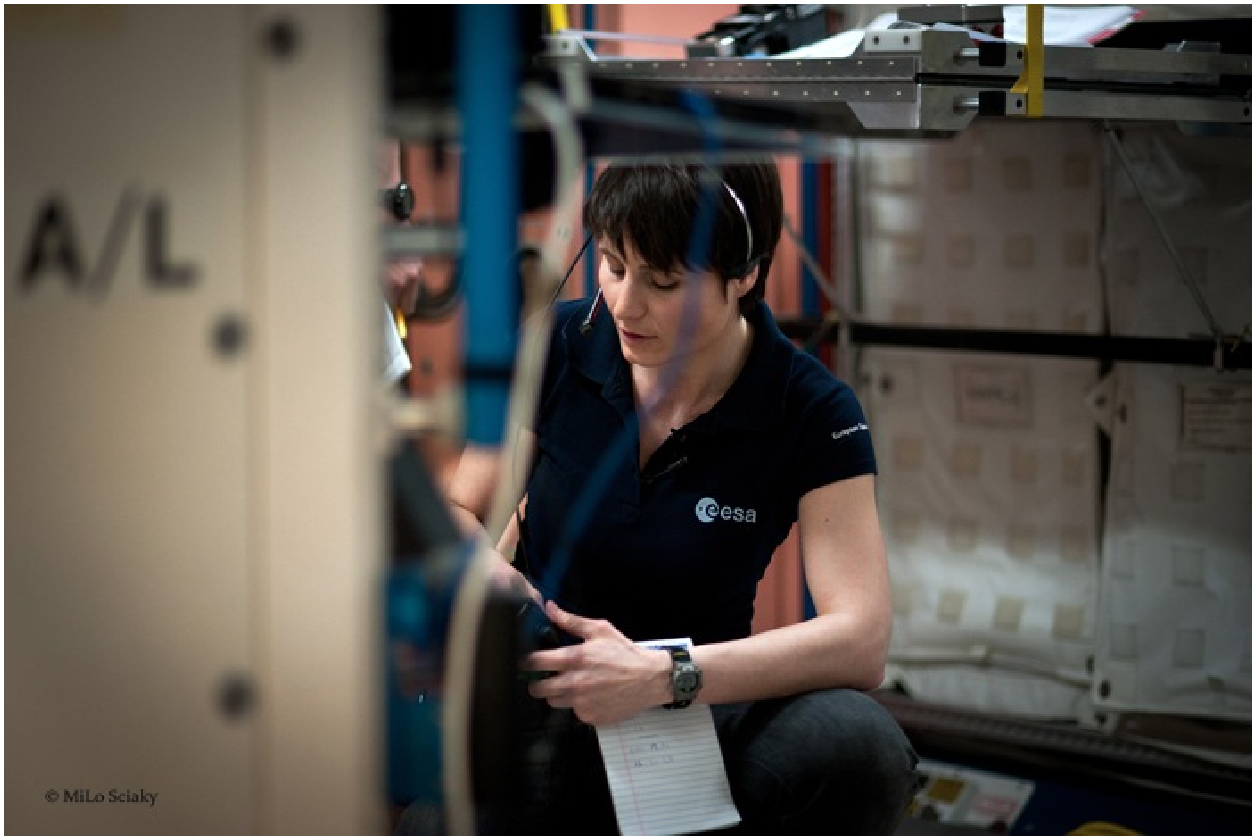
Let me know if you have any questions!

An emergency simulation begins with a quick briefing. Since most emergency scenarios require crewmembers to take up several possible roles, these roles are assigned in the pre-brief. An actual crew preparing for flight will establish fixed roles during training and stick to those in case of an actual emergency onboard. Since I did this training before being assigned to a crew, instructors had us rotate through the different roles. Training with me for this simulations were Japanese astronaut Norishige Kanai (Nemo) and US astronaut Mark Vande Hei. Source: © Milo Sciaky

The first response to an emergency annunciation is most of the time to gather in a Safe Haven, a place with clean atmosphere and access to communication equipment and commanding laptops. In most cases the default Safe Haven is the Service Module in the Russian segment of the Station. The Soyuz vehicles, which are the crew's lifeboats, are docked to the Russian segment. From the Service Module the crew will assess the situation and take proper action working the emergency procedures. On the way to the Service Module it's a good idea to grab some breathing protection. Also, Nemo remembered to grab the CSA-CPs that are velcroed to the aft wall in Node 2 - these portable devices are used in an emergency to measure combustion products in the atmosphere and determine whether it's safe to breath without a mask. Source: © Milo Sciaky



This was a fire scenario and in this case I was staying behind in the Service Module while Nemo and Mark built the "forward response team" that was looking for the fire. Coordination here is key. Sometimes the quickest way to locate a fire behind a rack is via the information on the computer - for examples on tripped electrical switches - and this information must be found and passed to the forward team. Also, when it comes to powering down equipment or even an entire module, it's the person staying behind in the Service Module who is in charge. Source: © Milo Sciaky



In this scenario I was part of the "forward response" team. The CSA-CP says the atmosphere in Node 2 is still safe to breath, so no breathing protection required. Source: © Milo Sciaky

Here Mark and I are looking for a fire hidden behind racks in the US Lab. We are wearing fire respirators, that filter toxic combustion products for about 90 minutes. The CSA-CP in my hand has a long probe that can be inserted through fire ports to sample the atmosphere behind a rack panel. Source: © Milo Sciaky

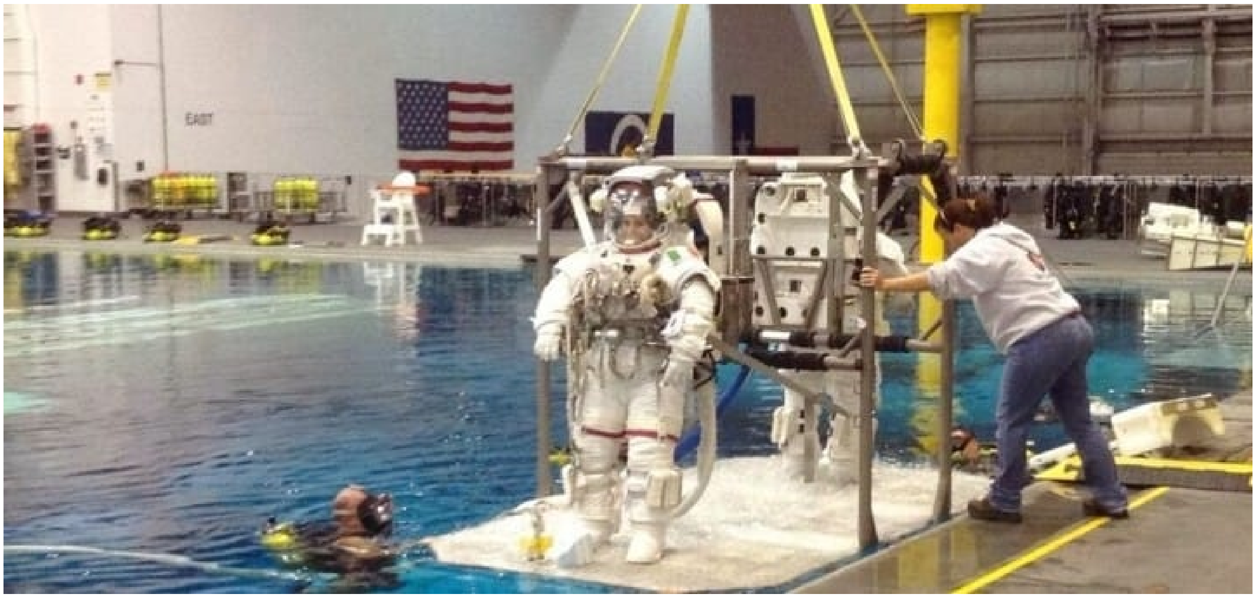
Once the fire is located behind a rack, procedures will call for equipment power-down or even for power-down of an entire module. If readings indicated the fire is still burning, it might be necessary to discharge a fire extinguisher. On the non-Russian part of the Station we have CO_2 based extinguishers. Before discharging them, we need to switch from wearing respirators (which don't filter CO_2) to wearing oxygen masks in positive pressure mode. Source: © Milo Sciaky

Participating in a fire emergency scenario. Source: © Milo Sciaky

Participating in a fire emergency scenario. Source: © Milo Sciaky

Italian translation of this logbook entry: [L-389: Una giornata di simulazioni di emergenze](), by Paolo Amoroso—AstronautiNEWS.

L-387



Phases of an EVA simulation at NBL by Samantha Cristoforetti and Peggy Whitson. Source: Lionel Ferra

Houston (USA), 2013.11.09—One more full day of training at the Neutral Buoyancy Laboratory (NBL) yesterday, together with veteran spacewalker Peggy Whitson. .

First we practiced the replacement of a failed SASA antenna on the top of the truss. That's our S-Band antenna, that provides the main audio, telemetry and commanding link to the ground. Since the spare SASA is tucked behind the truss, this is not a task that we can do with the support of the robotic arm. Instead, we practiced a leapfrogging technique making use of multiple APFRs (that's the Articulating Portable Foot Restraint - see L-411 Logbook if you missed

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For this technique, one crewmember is in the APFR holding the antenna, the other crewmember rolls the APFR plate over towards the direction we need to move and then goes set up another APFR further along the path to receive the antenna. And so on for a few relay steps.

After that we practiced removing one of the four Control Moment Gyroscopes, the components that are used most of the time to maintain Station attitude.

In the picture composition (courtesy of Lionel Ferra) you can see the briefing, the moment when we were lowered into the water and our helmet camera views.

Italian translation of this logbook entry: L-387: Un'altra giornata sott'acqua!, by Paolo Amoroso—AstronautiNEWS.

L-386

The landing of the Soyuz TMA-08M. Source: NASA/Bill Ingalls

Johnson Space Center (Houston, USA), 2013.11.10—Boy, does time fly! It seems like yesterday that I was commenting live images of the launch of Soyuz TMA-09M from the Italian Space Agency headquarters in Rome and here we are: tonight Luca, Karen and Fyodor will return to the planet after having the ride of their lives as they reenter the atmosphere. I'm lucky that I'll have the chance to follow the reentry and the landing from Mission Control Houston.

How does a reentry happen? At 23:26:00 GMT the undock command will be sent. The system is very simple: within about 2.5 minutes the docking system hooks will open and the spring loaded pushers at the docking interface will give the Soyuz a small separation velocity of about 12 cm/sec.

Once at a safe distance, after ca. 3 more minutes, the Soyuz attitude control thrusters will fire for about 15 seconds. We call that separation burn.

Only after that will the guidance and navigation system of the Soyuz be turned on. First thing, it will spin the ship to find the Earth with its infrared sensors. Once the sensors capture the Earth's infrared emissions, they will start feeding the attitude control system the information needed to orient the Soyuz along the local vertical, with the periscope towards Earth, so that the Commander can visually verify that the orientation is correct. The Soyuz will also be flying "backwards", with the nozzle of the main engine facing in the direction of flight. That's called "braking attitude".

The braking burn is scheduled for tonight at 1:55:33 GMT and will last about 4.5 minutes. Here are some pretty amazing numbers. The orbital velocity of the Station is somewhere between 7 and 8 km per second, or between 7000 to 8000 meters/second. The deorbit burn is "only" 128 meters/seconds. That's all it takes to be hitting the ground less than an hour later!

But before that module separation will have occurred at about 02:23 GMT: remember that only the central, bell-shaped descent module can survive atmospheric reentry intact!

At about 10 km the active reentry guidance will terminate and the parachute will be opened. Expect that at about 02:35 GMT. It will then be about 15 minutes until impact, during which the heat shield will be ejected to expose the retrorockets and the seats will extend up to the "armed" position to give the shock absorbers the travel they need to work effectively. Even with the retrorockets firing, that you can see in the picture, it's certainly not a soft landing!

Enjoy the ride and be safe Luca, Karen and Fyodor. Looking forward to seeing you soon!

Photo credit: NASA

Italian translation of this logbook entry: L-386: Aspettando l'atterraggio di Luca, Karen e Fyodor!, by Paolo Amoroso—AstronautiNEWS.

L-385

Karen Nyberg, Fyodor Yurchikhin and Luca Parmitano shortly after landing the Soyuz TMA-09M. Source: NASA/Carla Cioffi

Houston (USA), 2013.11.11—It's a federal holiday today here in the US, so no training.

Happy Veterans' Day, especially to those who have served!

While I enjoy a pleasant sunny day in Texas- one of my last days at this latitude before flying to Europe on Friday - Luca and Karen are on their way to Houston after their safe landing last night. Reentering from orbit takes only a few hours, but the trip from Kazakhstan is quite a bit longer. They will arrive late tonight and will spend a few days in dedicated crew quarters at Johnson Space Center, before the flight surgeons will clear them to go home. Their schedules in the coming weeks will be busy with rehabilitation, collection of scientific data and debriefs. And of course with catching up with family and friends, who'll likely have a lot questions!

Video: Soyuz undocking, reentry and landing explained (20:24)

How does an astronaut return to Earth from the International Space Station? What does it feel like to re-enter the atmosphere? How does the Soyuz capsule function?

If you're interesting in learning more about the Soyuz reentry and landing, I recommend this brand-new video produced by the European Astronaut Center. It's a mix of real footage - including from inside the descent module - great 3D animations and interviews with veteran astronauts who've been on that roller coaster ride before. I think you'll enjoy it!

Italian translation of this logbook entry: L-385: Un bel video ESA sul rientro della Sojuz, by Paolo Amoroso—AstronautiNEWS.

L-384

Samantha Cristoforetti at the JSC with biomedical sensors for the ESA experiment Circadian rhythms. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2013.11.12—Two long simulations today.

In the morning it was Cygnus rendez-vous and capture day with Terry and Butch at the robotic workstation, mainly working through different malfunction scenarios related to the robotic arm or the visiting vehicle.

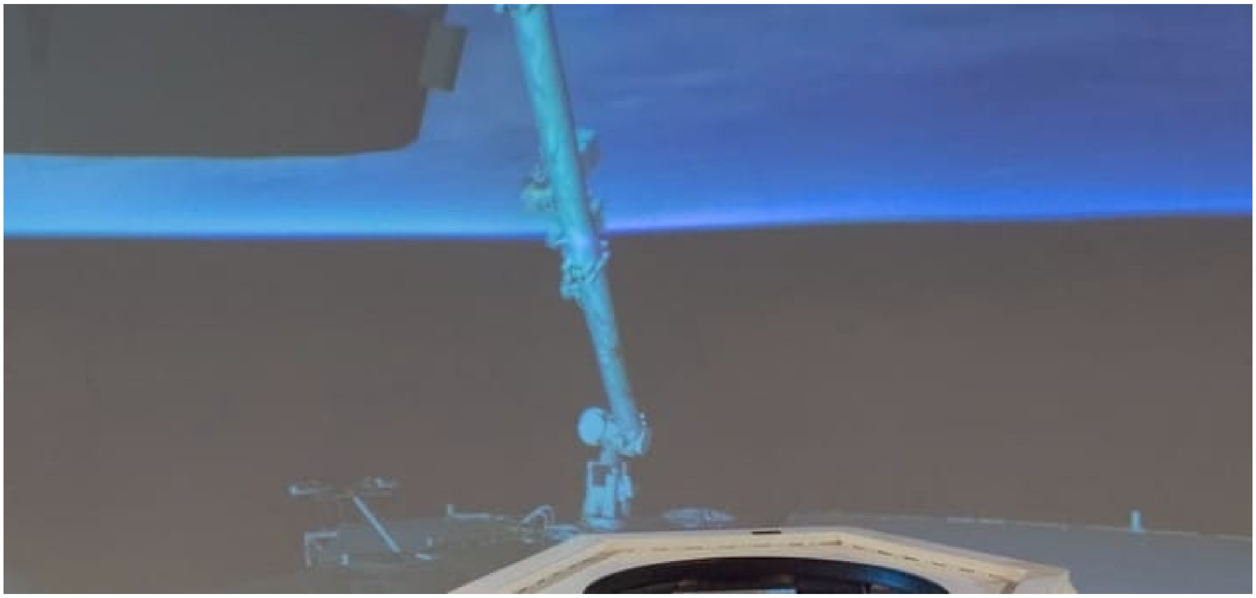
Biomedical sensors for the Circadian Rhythms experiment. Source: Samantha Cristoforetti

In the afternoon I was solo in the ISS mockups practicing procedures related to water: collection of water samples, on-board microbiology testing and Total Carbon Analyzer operations and iodine testing with the spectrophotometer. We put iodine in the potable water lines to prevent bacterial growth, but we also remove that iodine before the water is dispensed for consumption. That's why we periodically test for iodine to make sure the removal process is working well.

Today I'm also starting my very first Baseline Data Collection as a human subject. This morning I had an introduction to the instrumentation and in a couple of hours I will start a 36-hour monitoring period in which I will wear temperature sensors on my forehead and sternum. The aim is to record daily fluctuations as part of the ESA experiment "Circadian Rhythms". As you can see in the picture, tomorrow will be a bandana day. The investigators kindly provided one with the experiment kit!

Italian translation of this logbook entry: L-384: Bandana day in nome della scienza, by Paolo Amoroso—AstronautiNEWS.

L-383



Samantha Cristoforetti in a photography simulation of Cygnus at JSC. Source: NASA/Harnett

Johnson Space Center (Houston, USA), 2013.11.13—As I mentioned in yesterday's Logbook, I had a chance yesterday to practice rendezvous and capture ops with crewmates Terry and Butch, probably the last time we get to do a three-person sim in the Cupola dome.

The work can actually be performed by two people, namely a prime Visiting Vehicle Officer (VV1) with the support of a second trained crewmember (VV2). The roles are swapped at the 10-meter capture point. VV2 becomes M1 and is prime for the capture, meaning he/she is actually flying the arm. VV1 becomes M2, a supporting role in the capture operations: while M1 is focused on the target to bring the arm end effector into the grapple envelope, M2 is in charge of cameras, communication with the ground and calling out the distance to the grapple fixture.

If there is a third trained crewmembers onboard, we have the luxury of having a VV3: a third set of eyes and someone who can be specifically in charge of our malfunction cue card.

In the picture attached you can see our simulated Cygnus approaching the 10-meters capture point and the Canadarm2 ready in the capture initial position.

Photo credit: NASA/Harnett

Italian translation of this logbook entry: L-383: Chi fa cosa nel giorno del rendezvous e cattura, by Paolo Amoroso—AstronautiNEWS.

L-382

Expedition 42/43 crew members Samantha Cristoforetti, Barry Wilmore, Terry Virts during FF T&C/R Mini Sim 1 in the SES Alpha Cupola trainer. Credit: Lauren Harnett

Johnson Space Center (Houston, USA), 2013.11.14—When we monitor the approach of a visiting vehicle, like Dragon, Cygnus or HTV, we typically have three camera views set up at the robotic workstation..

Since we use the Cupola as the prime workstation (there is a backup in the Lab), you might wonder why we need camera views at all, since we have a direct view through the windows. The reason is that we need overlays, i.e. extra information that is generated by the software and superimposed on the camera image. One big element is the corridor in which the vehicle is supposed to be during the approach. We also have a grapple volume overlay in which the grapple fixture needs to be for capture and a lot of telemetry data.

The central monitor has the end effector camera view with the grapple envelope overlay: the cross and the bars you can see in the picture. In the picture the vehicle is still too far, but when it holds position at the capture point, the target located next to the grapple fixture is in view.

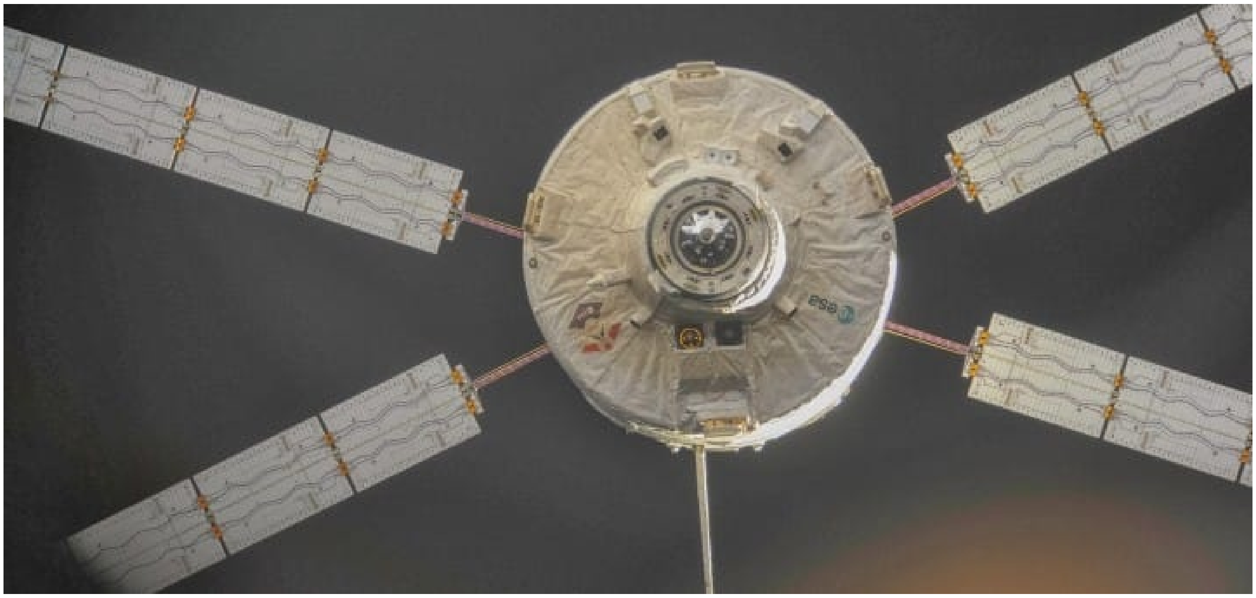
The overlay allows us then to understand what translational and rotational corrections we need to make to align the end effector with the pin, as well as when we are at the right distance to press the trigger to close the snares.

Here are some more pictures of this training session.

Photo credit: NASA/Harnett

Italian translation of this logbook entry: L-382: Perché servono le telecamere anche con le finestre grandi, by Paolo Amoroso—AstronautiNEWS.

L-380



ATV-4 Albert Einstein leaves the ISS. Source: NASA/ESA

Cologne (Germany), 2013.11.16—Nice to be back home in Europe after an intense six-week training trip to Johnson Space Center. Although I certainly didn't mind at all the mild Texas temperatures this time of the year!

I have a non-training week coming up - a couple of free days and then several briefings, meetings and administrative work at the European Astronaut Centre.

I'll pick up training again on Nov 25th with my second ATV week, together with crewmate Sasha. Schedule is not final yet, but I might well be on ISS when our final ATV, Georges Lemaître, will depart. In the picture you can see the recent departure of ATV4 Albert Einstein.

Until I resume training, this Logbook will be LOS*. See you on the other side!

* If LOS doesn't ring a bell, see here.

Picture credit: NASA/ESA

Italian translation of this logbook entry: L-380: Di ritorno in Europa e un breve LOS prima di ATV, by Paolo Amoroso—AstronautiNEWS.

L-365

The launch of Expedition 38 with the Soyuz TMA-11M on November,7 2013. Source: NASA

Cologne (Germany), 2013.11.24—It's a big day! According to the current plan, the launch of our Soyuz TMA-15M will be on November 24th, 2014.

Yes, if you noticed that I adjusted the math of the countdown, you're right: when I started the Logbook last summer the launch was scheduled for December 1st. And the new launch date is not carved in stone either: adjustments of the launch manifest are still likely to occur.

But for now, celebrate with me: it's L-1 year!

Photo: launch of Exp 38 on Nov 7th, 2013. Credit: NASA

Italian translation of this logbook entry: L-365: Oggi manca un anno al lancio, che ci crediate o no!, by Paolo Amoroso—AstronautiNEWS.

L-364

ATV-2 Johannes Kepler. Source: NASA

European Astronaut Centre (Cologne (Germany), 2013.11.25—Back into the ATV* world with Sasha at the European Astronaut Centre here in Cologne.

As the backup of Expedition 40, who will be on ISS for the most part of ATV5 mission, Sasha and I are receiving full training on ATV rendez-vous and docking monitoring and all attached phase operations, like water and gas transfer.

However, unless we really need to fly six months earlier - which is very unlikely! - or the launch of ATV5 slips significantly, my fellow Shenanigan Alex and his crewmates will take care of all those operations.

However, it is well possible that Sasha and I will be the ones closing the hatch and sending the very last ATV on its destructive ride through the atmosphere and into the ocean. So, today we had our introduction into departure operations. Much simpler than rendez-vous ops, as you can imagine: after all, when the general trajectory is "away" from you, as opposed to "towards" you, things are inevitably less complex.

Can you recognize ATV in the picture? That's ATV2 Johannes Kepler after undocking, courtesy of Exp 28 (credit: NASA).

* In case you're not familiar with ATV, this older Logbook has some general words.

Italian translation of this logbook entry: L-364: Se siamo quelli che faranno tornare a "casa" l'ultimo ATV, by Paolo Amoroso—AstronautiNEWS.

L-363

An ATV cargo approaching the ISS. Source: NASA

European Astronaut Centre (Cologne (Germany), 2013.11.26—Sasha and I had another full day of ATV training today, starting with a lesson on docking system malfunctions.

ATV uses a slightly modified version of the Russian docking system, the one of the Soyuz and of the Progress. It's a very robust system that has proven itself time and again. However, we do have a few contingency plans in case something goes wrong.

The main thing that needs to work is the retraction of the docking probe. As you can see in the picture, once ATV is on orbit the docking probe is extended. It's the head of the docking probe that makes the first mechanical connection to Station. Then the probe is slowly retracted, pulling in ATV until the full docking interfaces can be mated and the hooks can be closed.

If the probe can not be retracted for whatever reason, we have a problem. The probe head is captured, but we have no rigid mechanical connection between ATV and Station. With ATV attached only via the probe, we can not apply control torques to the Station to keep it in a desired attitude. Until we solve the problem, we have to stay in free drift.

That's why, if we really could not retract the probe, neither automatically nor via manual commands, pretty soon we would have to send ATV away. For a really bad day, we even have to option to pyrotechnically separate the docking mechanism. That would be really the last resort option, though, because if would end ATV's mission for good and make the docking port unavailable.

Photo credit: NASA

Italian translation of this logbook entry: L-363: Gestire i malfunzionamenti del sistema di docking dell'ATV, by Paolo Amoroso—AstronautiNEWS.

L-362

A water tank with transfer pump in the ATV mockup at the EAC in Cologne. Source: Samantha Cristoforetti

European Astronaut Centre (Cologne (Germany), 2013.11.27— Another day of ATV training for Sasha and myself at the European Astronaut Centre.

In the morning we had more practice with rendez-vous and docking malfunction. In the afternoon we'll have a long simulation of attached phase operations: that's all that occurs when ATV is docked to the International Space Station.

ATV is a resupply ship and it can bring, among many other things, water (from Torino, Italy, by the way). All ATVs so far have brought "Russian" water, which is supplemented with silver ions to prevent microbial growth. "American" water uses iodine instead and the two should not be mixed.

"Russian" water can be transfered into the big tanks in the service module, or into portable water tanks, like the one you can see in the picture. One of these tanks is also always installed in the toilets to collect urine, although the US toilet is now nominally connected to the Urine Processing Assembly and the portable urine tank is a backup option.

Managing water and waste fluids on board is a complex tasks that is the responsibility of dedicated specialists on the ground. If it is decided that some urine must be disposed of as waste, we can transfer it into the ATV tanks once we have offloaded the fresh water to Station. The portable tanks have a soft bladder inside that actually contains the fluid: by applying pressure in the volume outside of the bladder, we can "squeeze" the fluid out and into the ATV tanks.

This is what the setup you see in the picture is for: once we have established the connection to the water control panel and opened the valves, we can transfer the water by pressurizing the bladder via a compressor or, as in the case of the picture, with a manual pump - in the unlikely event that all compressors onboard failed.

As you can imagine, once we have transferred some urine, we really don't want any confusion about what kind of fluid is in the ATV tanks. Just to be sure, we swap the blue water label for the orange one you see in the picture!

Italian translation of this logbook entry: L-362: La cosa più importante in questi casi: non mischiare fluidi diversi, by Paolo Amoroso—AstronautiNEWS.

L-361

The ATV-3 Edoardo Amaldi docking mechanism seen from the Zvezda module of the ISS. Source: NASA

European Astronaut Centre (Cologne (Germany), 2013.11.28—How does it look when you open the hatch of the Service Module hatch after ATV docking? Take a look at this picture from ISS Expedition 30: you have a front-seat view of the ATV docking system!

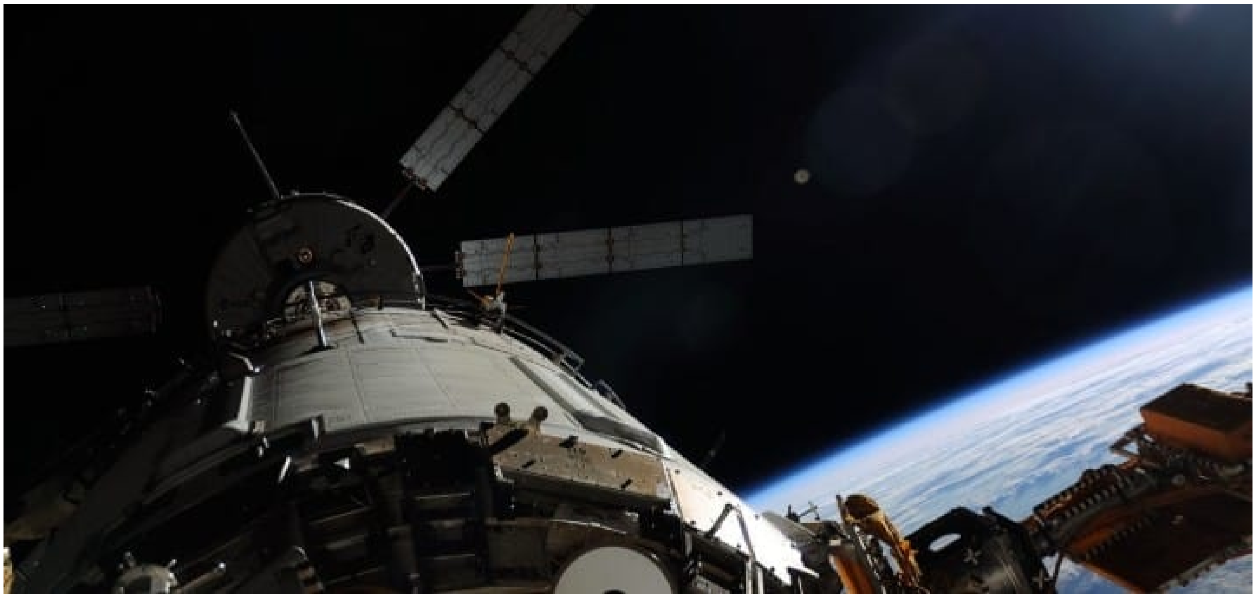
Sasha and I have had to do this operation several times during our simulations this past week. When you release service module the hatch and move it out of the way, the cone that is normally exposed to outer space becomes visible. That cone is the passive part of the docking mechanism: when the docking probe makes contact with the conic surface, the wall guides it in until it's captured by the latches.

If you missed it, you can take a look at L-363 Logbook for more info about the docking system. In this picture, of course, the docking sequence is completed and the docking probe is fully retracted. Also, before opening the cone-shaped hatch of the Service Module, the crew would have leak-checked the vestibule, which is the little volume between the two hatches that is formed at docking. And finally, it would be time to actually open the ATV hatch and ingress.

You can find more info about ingress operations in this older logbook!

Italian translation of this logbook entry: L-361: Un posto in prima fila sul meccanismo di docking dell’ATV, by Paolo Amoroso—AstronautiNEWS.

L-360



The final phase of the ATV-4 Albert Einstein approach. Source: NASA

European Astronaut Centre (Cologne (Germany), 2013.11.29—A couple of successful evaluation simulations today for Sasha and myself at the European Astronaut Centre, dealing with all kinds of malfunctions during rendez-vous and docking, as well as undocking and departure of ATV.

Some more training is coming up early next year and then we'll have our final ATV rendez-vous exam in Star City, just before Sasha will leave for Baikonour as backup crewmember of Expedition 39.

In the picture, courtesy of Exp 36, you can see the final approach of ATV4 "Albert Einstein" last summer. You can probably make out the illuminated target: that's what we use to visually monitor distance, corridor and relative attitude to Station, to make sure the vehicle is properly aligned when it makes contact.

Some more info on the ATV blog!

Italian translation of this logbook entry: [L-360: Passate le simulazioni di valutazione sull'ATV!](), by Paolo Amoroso—AstronautiNEWS.

L-358

Verification of acceptance of a Soyuz at the RSC Energia plants in Korolev, Russia. Source: RSC Energia

Star City (Moscow, Russia), 2013.12.02—Pretty exciting start of my three-week training session in Star City! Together with my Commander Anton, I got to do an acceptance verification of the Soyuz 713. That's the spaceship of fellow Shenanigan Alex on his Soyuz TMA-13M flight to ISS in May next year, together with Max and Reid.

Verification of acceptance of a Soyuz. Source: RSC Energia

It was an unexpected treat to be able to go! More often than not only Russian cosmonauts get to go, because the manufacturing schedule and our training trip schedule don't necessarily harmonize.

But they did in this case and so Anton and I spent the morning inside the orbital module and the descent module, which are stacked on top of each other at the Energia facilities in Korolev, on the outskirts of Moscow. With the help of the specialists, we worked our way through a long checklist of things to verify, from cargo straps to valve controls to accessibility of the CO_2 scrubbing cartridges under the right seat. Anton is of course a veteran Soyuz commander, but for me it was the first chance to "feel" a real, brand-new, space-bound Soyuz!

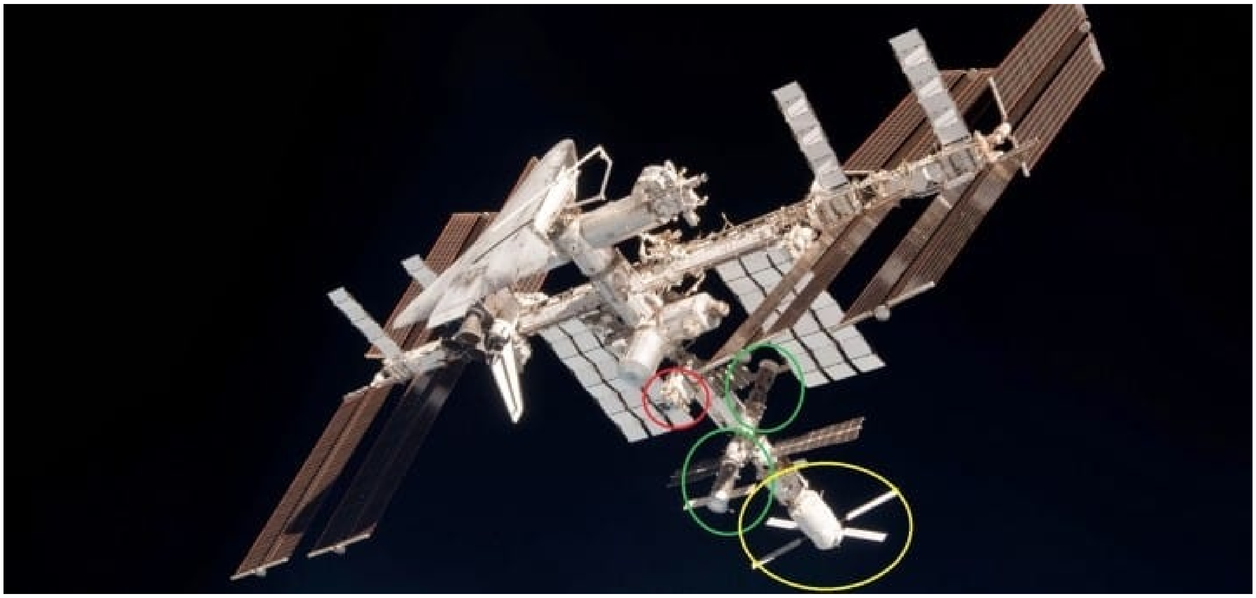
Later in the morning we were joined by specialists for Svezda, the seat manufacturer. They secured the pyrocharges of the seats and connected an external supply of pressurized air, so that we could experience the extension of the seat from the usual low position to the upper "armed" position. On an actual flight profile, seats are extended before landing to provide dampening of the impact.

Unfortunately we were not allowed to take photos, but on the Energia website I found these two pictures from a similar verification last year.

Notice the fashionable headwear!

Italian translation of this logbook entry: L-358: Ho passato la mattina nell'astronave di Alex, by Paolo Amoroso—AstronautiNEWS.

L-357



The docking hatches of the Russian segment of the ISS. Source: NASA/Samantha Cristoforetti

Star City (Moscow, Russia), 2013.12.03—Back at the Soyuz controls today to fly some manual docking. Always a great way to end a training day!

As you probably know, the Soyuz docks to the Space Station automatically if everything is nominal. Our manual docking training covers for two types of contingency: a failure of the on-board computer and a failure of the Kurs, which is the systems of antennas (both on the Soyuz and on Station) that gives the computer the necessary information about the relative position and speed with respect to ISS.

A failure of the Kurs is a slightly lighter scenario, because a functioning computer can anyway make life easier in some ways. For example, when we make a correction of the orientation, the attitude thrusters inevitably give the Soyuz also a forward impulse: the computer automatically compensates for this with a burn in the aft direction, so that we don't get forward speed that we never intended to acquire. If the computer fails, we have to do those compensations manually.

We also have different scenarios in terms of illumination (day or night), attitude mode of the Station (inertially stabilized or rotating with the local vertical as it moves around the Earth) and initial conditions (how far from Station? with a safe speed or with excessive speed that requires immediate actions to avoid collision with Station? already in front of the docking port or not?)

Also, different docking ports have slightly different challenges, mainly because of the different target alignment. In the pictures I have shown the four docking ports that a Soyuz can fly to: the Service Modules aft (yellow, an ATV is docked in the picture); Docking Compartment 1 and MRM2 (green, Soyuz or Progress docked in the picture); and MRM1 (red, port is free in the picture).

We also practice relocating the Soyuz from one docking port to another. That's by the way not a contingency mode: relocations can only be flown manually.

Italian translation of this logbook entry: L-357: Dove parcheggiare la vostra Sojuz, by Paolo Amoroso—AstronautiNEWS.

L-356

The Soyuz medicine box. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.12.04—A four-hour Soyuz sim with Anton today, practicing pre-launch ops, launch, post-orbital insertion checks and initial correction burns to get on our way to ISS.

We didn't get any major computer or engine failures, because those would force us to revert back to the two-day rendez-vous profile and the point today was to stick to the quick scheme. But we did get our share of little malfunctions, like a failure of the radio transmitter, a loss of O_2 partial pressure readings or a broken fan in the CO_2 scrubbing equipment.

I also had a class on the medical supplies that will fly with us on the Soyuz. A little medicine box is stowed between the Commander's and the Flight Engineer's seat. As you can see in the picture, tablets are organized in booklets, so nothing floats away: practical in weightlessness!

Italian translation of this logbook entry: L-356: L'armadietto dei medicinali *[della Sojuz](), by Paolo Amoroso—AstronautiNEWS.*

L-355

Tom Marshburn uses the body mass measurement device on the ISS. Source: NASA

Star City (Moscow, Russia), 2013.12.05—Some more Soyuz manual flying today and then a class dedicated to Russian medical equipment on Soyuz and on Station.

When we fly on the Soyuz we wear a medical telemetry belt with sensors that can measure our electrocardiogram and our frequency of breathing: it's actually the same belt that I've worn several times during underwater Orlan training in the Hydrolab.

As for the Station, the one item in the Russian segment that I will be using regularly is the body mass measurement device. Since we can not use regular scales to measure our body mass in weightlessness, we had to get creative and dig into the physics books to find a physical relationship that is still valid in zero-G and allows us to measure mass.

Here's where your oscillator formulas come in handy. It's actually pretty straightforward: if you oscillate a mass attached at the end of a spring, the frequency of the oscillation is related to the mass via a well known equation. So if YOU are the mass that is oscillating, there you go: you measure the frequency of oscillation and you'll know if you've been eating too many of those delicious space food pouches!

In the photo you can see Tom Marshburn using the mass measuring device (photo: NASA).

Here's also a neat video demo with detailed explanation by Jeff Williams.

Video: Mass Measurement (2:54)

Italian translation of this logbook entry: L-355: Come "pesare" un corpo in assenza di peso, by Paolo Amoroso—AstronautiNEWS.

L-354

Astronaut Carl Walz catalogs water containers in the Zvezda module of the ISS. Source: NASA

Star City (Moscow, Russia), 2013.12.06—Today I got to spend some time in the ISS mockups here in Star City, in particular in the Service Module. I have attached a panorama of the interior, so you can take a tour!

As a non-Russian crewmember I will not be expected to perform complex work in the Service Module: in fact, I am not trained for any kind of work on the systems, except for the interaction with emergency response items and with basic life support equipment.

These include the toilet, of course, which is however very similar to the one in Node 3 that we would typically use as non-Russian crew. Actually, it's pretty much exactly the same toilet, except that the Node3 unit is nominally connected to the Urine Processing Assembly to recover the urine to potable water.

Water delivery is another basic life support function. Just like in the US

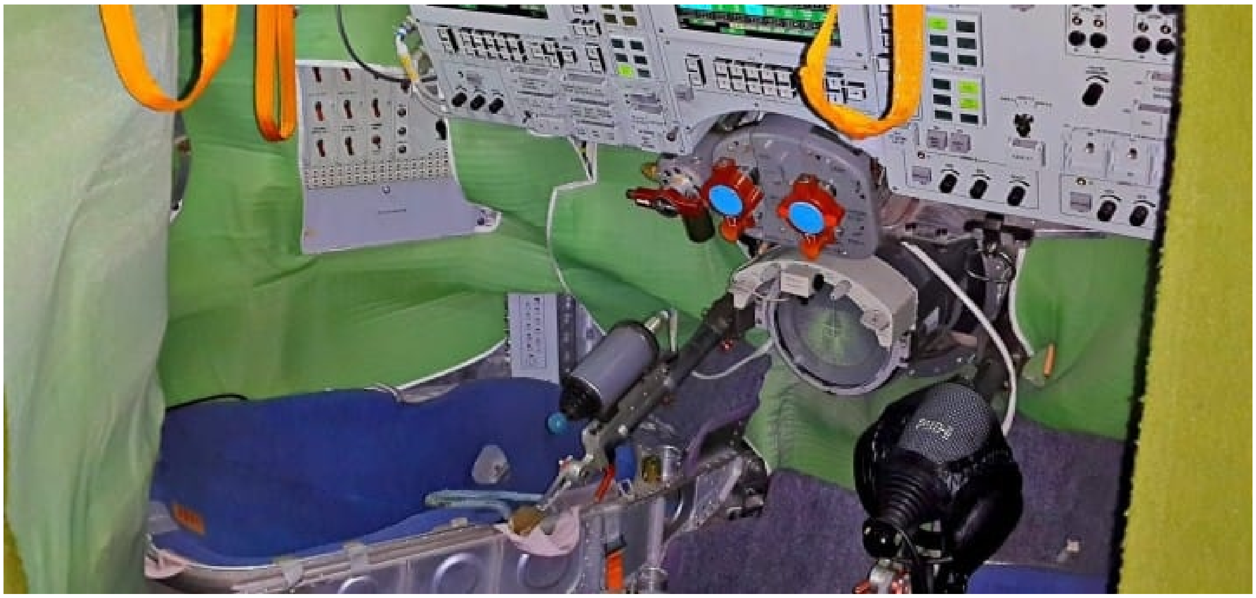
Lab, the Service Module has a water delivery unit (on the "wall" above the table) to rehydrate food packages. It has two separate outlets for "hot" and "warm" water and the possibility to set the quantity of water needed according to the instructions on the food package.

On the other side, opposite to the table, is another water delivery system, typically used to simply drink ambient temperature water.

And in the table itself is the food warmer for the Russian food cans.

Italian translation of this logbook entry: L-354: Usare l'acqua nel Modulo di Servizio, by Paolo Amoroso—AstronautiNEWS.

L-353



The Soyuz docking simulator in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.12.07—When I'm in Star City, manual docking sessions are regularly put on my training schedule, so I can maintain and possibly improve my skills before serving as a backup crewmember next May.

I have attached a picture of the simulator we use to practice manual flying. As you can see, the manual controls and the periscope view are only available in the center seat, where the commander sits. As a flight engineer sitting in the left seat, I don't have access to those commands.

Still, as a flight engineer I am required to show the same proficiency as the Soyuz commander. In spaceflight we like to plan for all possible contingencies: just as we design vehicles to have full redundancy on all critical systems, we also plan to have more than one crewmember capable of fulfilling critical tasks. And getting successfully to Station, you'll probably agree, is pretty critical to mission success!

Italian translation of this logbook entry: L-353: Perché questo è spesso il *mio ufficio a Star City, by Paolo Amoroso—AstronautiNEWS.*

L-352

A Soyuz docked at the ISS with the periscope highlighted. Source: NASA

Star City (Moscow, Russia), 2013.12.08—I mentioned in yesterday's Logbook that the Soyuz commander has a periscope view available. You can see the actual periscope in the attached picture.

As you might have noticed, it has two circular openings offering two views that are offset by 90 degrees. To change between views a mirror inside the periscope is rotated.

Most of the time the view of interest is the one "straight out" along the axis of the periscope. Whenever there is a need to fire the engines, the reference orientation in which the Soyuz puts itself is along the local vertical: in this orientation the periscope faces towards Earth. The optical setup is such that the commander sitting in the center seat will see the entire globe symmetrically in the field of view if the Soyuz is properly oriented. Also, any feature on the surface of the Earth will be running from top to bottom (or from bottom to top if it's a braking attitude).

When we approach the Station for rendez-vous the mirror is turned so that the commander can now have a forward view. This is the view we would use to align the Soyuz manually if we had to fly a manual docking.

Should the mirror remain stuck on the initial position - you guessed it - we have backup option. We can use a camera view and a second target which is aligned with the camera: that's the circular target on yesterday's picture!

Picture credit: NASA

Italian translation of this logbook entry: L-352: Cos'è questa storia del periscopio?, by Paolo Amoroso—AstronautiNEWS.

L-351

Samantha Cristoforetti trains to lift from the rescue helicopter. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2013.12.09—Wet start of the week for Terry and myself today. For our first class this morning we headed to the Hydrolab, where we practiced operations that we would have to perform to attach ourselves safely in case we had to be airlifted by rescue helicopters.

In Forel suit, ready for lifting. Source: Gagarin Cosmonaut Training Center

On your usual landing day, of course, helicopters simply land next to the descend module and rescue personnel helps the crew to get out. However, there could be situations (and there have been in the past) in which the helicopter can not land. And for sure there could be water splashdowns, especially in the case of a rocket failure in the later portion of the 8-min ride to orbit, when the descent module would end up in the Pacific.

Lifting begins. Source: Gagarin Cosmonaut Training Center

Terry and I got to practice both in the Sokol, our regular pressure suit, and in the Forel dry suit, which is part of our survival equipment. We had a crane instead of an actual helicopter, which makes things a bit easier. But we've both experienced real helicopter airlifts in the past as part of our training as military pilots.

Preparation for lifting in Sokol suit. Source: Gagarin Cosmonaut Training Center

All operations leading up to the helo reascue- getting into the Forel, leaving the descent module, using signaling equipment and other survival items - we practiced last summer. You can see some pictures here.

Oh, and the Hydrolab of course is usually dedicated to spacewalking training. Here are some pictures of that, if you missed them.

Italian translation of this logbook entry: L-351: Quando gli amici arrivano a sollevarvi, by Paolo Amoroso—AstronautiNEWS.

L-350

The Soyuz TMA-15M crew in a Sokol suit for a simulation in Star City. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2013.12.10—Today we finally had our first real Soyuz sim with our complete crew! Terry joined Anton and myself for a pretty adventurous afternoon in which we had to practice fighting for our life when smoke started to fill up the small volume of our descent module just after our simulated injection into orbit.

In situations like this, your best friends are good crew coordination and your pressure suit!

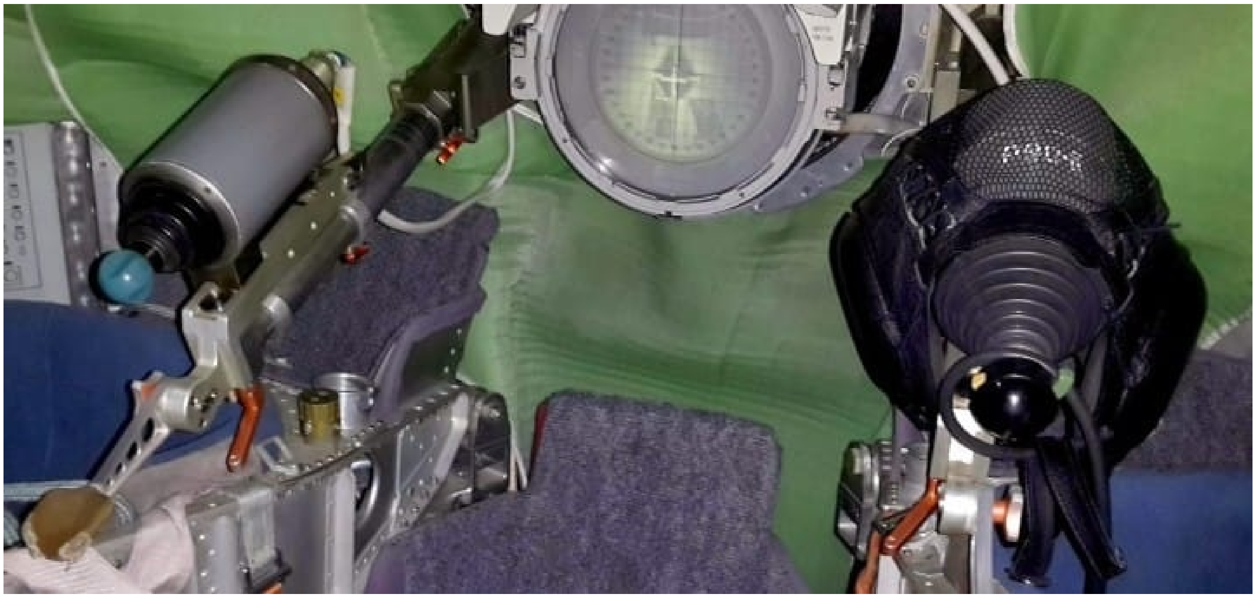
Normally air from the cabin is circulated through the suit. In case of smoke, however, we would immediately close the helmets, turn off the ventilation and start instead pure oxygen flow into the suit from the oxygen tanks. The continuous flow of fresh oxygen prevents fogging of the helmet, but it also means that we're introducing oxygen into the cabin via the suit relief valve.

As the oxygen concentration in the descent module grows, so does the flammability of the atmosphere. Latest at a concentration of 40% we want to fully depressurize, venting all the atmosphere to space. At that point we rely fully on the suits to keep us alive: they are designed to maintain an internal pressure of 0,4 atm, enough to avoid symptoms of decompression sickness, but also to make the suit very rigid.

In a fire scenario we need to act very quickly: before we can depressurize we need to leak check the suits to make sure we're not going to kill a crewmember when we vent the atmosphere. And in parallel we need to initiate the sequence that will lead us to a timely deorbit burn and a safe reentry. It was a very busy and very fun sim! And also, as we like to joke, a free sauna: with the helmet closed, the ventilation off and only the (smaller) oxygen flow, it gets quickly warm in the Sokol!

Italian translation of this logbook entry: L-350: Come la tuta Sokol può salvarvi la vita, by Paolo Amoroso—AstronautiNEWS.

L-349



The controls of the Soyuz Star City manual docking simulator. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.12.11—Some more manual approach and docking practice today!

Here's a closer look at the instruments we use. I have talked in the L-352 Logbook about the periscope view, which is oriented forward when we approach the Station. In the picture you can see the view when the Soyuz has docked: the romboidal target is aligned with the periscope and we need to keep it in the center with the crosses aligned. In this particular docking, if you look carefully, you can see a minor misalignment in pitch (the horizontal line is a bit low), which is still fully acceptable.

The big challenge in flying manually is that we don't have measurements of distance and speed. We assess the distance visually using the grid and a conversion table based on the apparent dimension of the Service Module, the docking port and the target. For example, we know that when the Service Module diameter is as wide as 1 grid division we are at 200 meters; if the diameter of the docking port is 2 divisions, we are at 70 meters; and if the target is 3 divisions, we are at about 3 meters from contact.

Speed assessment is a bit trickier and is based on the known acceleration of the thrusters. If we start from a closing speed of roughly zero and give a forward impulse of 10 seconds, we know that we have accelerated to about 0,4 meters per second. It gets more difficult in computer failure scenarios, because any time we use the orientation control on the right to adjust pitch or yaw, we also give a significant burn forward which is not compensated and needs to be accounted for. It's especially important when we make contact with Station: we want the speed to be between 0.06 m/s and 0,15 m/s. Especially not higher than that!

Italian translation of this logbook entry: [L-349: Come valutare velocità e distanza quando tutto il resto non funziona](), by Paolo Amoroso—AstronautiNEWS.

L-348

Fire simulation in the Zvezda module with Samantha Cristoforetti and the crew of the Soyuz TMA-15M in Star City. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2013.12.12—A Service Module full of smoke so thick we could hardly see each other and a fire hidden behind a panel to be found and put out. All that while wearing gas masks that can get very warm.

That was the beginning of the day for myself and my crewmates Anton and Terry. As soon as the Service Module filled up with simulated smoke, we grabbed our gas masks. We took a deep breath, put them on and then exhaled into the chemical cartridge to start the reaction that would give us oxygen to breath for the next hour or so. It's an isolated system: the reaction uses the CO_2 and water vapor we exhale to generate oxygen. It's also an exothermic reaction, meaning it generates heat: it takes a while to get used to breathing the warm, dry gas supply from the cartridge and we all had our share of coughing, but certainly better than being exposed to combustions smokes on a real day on orbit!

We did find and put out the fire in our first scenario and also went through the procedures to start the cleaning process of the atmosphere.

On our second scenario we simulated that we could not put out the fire. Since our Soyuz was docked to the "burning" module, we had to evacuate. The idea was for us to practice getting into our Sokol suits with our masks on and going through quick undocking procedures for an arbitrary orientation of the Station. A story for another day!

Photo credit: Gagarin Cosmonaut Training Center

Italian translation of this logbook entry: L-348: Addestramento antincendio con fumo e maschere antigas, by Paolo Amoroso—AstronautiNEWS.

L-345

Samantha Cristoforetti and the crew of the Soyuz TMA-15M in a simulation of evacuation of the ISS with the Soyuz for fire. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2013.12.15—This Sunday night I'm preparing for another trip to Energia, the Soyuz manufacturer: departure from Star City early tomorrow morning with Terry!

In the meantime, picking up the logbook where I left off, I'd like to finish the story of our fire evacuation training last week. As you might remember, we practiced fire scenarios in the Russian segment of the Space Station and eventually we were confronted with a fire that, in our simulation, we could not put out.

To make things worse, the fire affected the module to which our Soyuz was docked, leaving us with no choice but to leave the Station. Now, putting on the pressure suits Sokol while wearing the gas mask is a bit of a challenge. Initially you put on the Sokol like you normally would, up to the arms. The fun comes next: you take a deep breath, hold it, take off the mask, slide your head through the neck ring and put the mask back on, the idea here being that you need to avoid breaking your protection from smoke and toxic combustions products.

For our simulation, we actually had to move from the building that houses the Station mockups to the one across the street with the Soyuz simulator. During the warm months crews actually walk across the street with the mask on, but with snow and ice on the ground it's preferred that we take the mask off. So we got a non-functioning mask for the suiting up, making it a bit easier: in real life we would have to pay great attention at not collapsing the black soft bag - after an exhalation, that bag contains the supply of gas for the next breath!

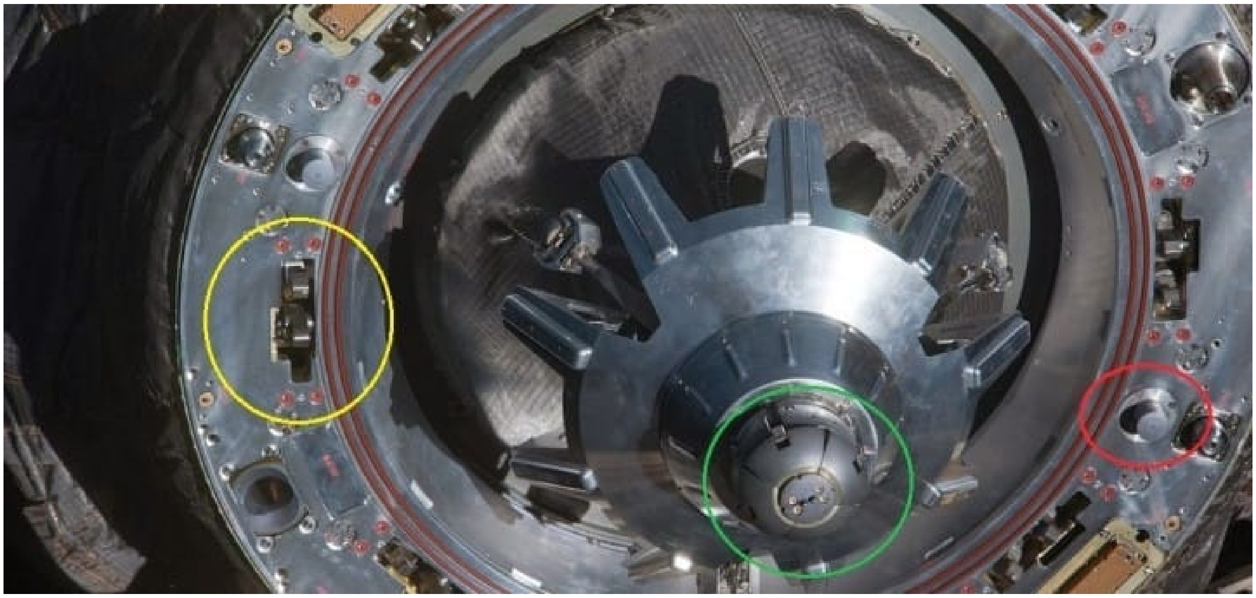
After suiting up, we took our seats in the descent module of the Soyuz simulator, which our instructors had already filled with pretty thick smoke. At times I could hardly see the control panel! After connecting our suits to the Soyuz oxygen supply, we took another deep breath, took the gas mask off and closed the helmet, isolating ourselves from the smoke.

For the next couple of hours we then proceeded to perform an emergency undocking from Station as well as the fire-related actions. If you missed it, you can read about the latter in the L-350 Logbook!

You can also find more pictures here! (Photo credits: GCTC)

Italian translation of this logbook entry: L-345: Prepararsi a una giornata storta: un'evacuazione simulata dopo un incendio, by Paolo Amoroso—AstronautiNEWS.

L-344



The docking mechanism of a Soyuz. Source: NASA

Star City (Moscow, Russia), 2013.12.16—Today Terry and I spent the day at the facilities of Soyuz manufacturer Energia in the town of Korolev in the Moscow metropolitan area. The name Korolev sounds familiar?

We had a number of different classes with high-fidelity hardware, including one on the docking system in which we could see the mechanism actually work, from the first capture of the probe head all the way to full probe retraction and closing of the hooks.

Unfortunately taking pictures is not allowed at Energia, but I have found this photo of the docking interface of an actual Soyuz or Progress.

In the green circle you can see the docking probe, which is fully retracted here. There are four petals on the probe: when any of these petals is pressed against the receiving cone of the Station during docking we get the "Contact" signal, the very beginning of the docking sequence.

Some time and several sensor signals later, the docking interfaces have made full contact and the hooks can be closed: you can see them in the picture, I have highlighted one pair in the yellow circle. In each pair, one hook is fixed and one is movable. The corresponding hooks on the Station sides are reversed, to that the movable hook of the Soyuz will grab the fixed hook of the Station and viceversa. We don't always close hooks on both sides.

I have also highlighted in red one of the two spring pushers. During the docking sequence they are compressed as the interfaces are joined, thereby storing energy in the springs. At undocking, as soon as we open the hooks that energy is released and the Soyuz is literally pushed away. A simple, clever system!

Italian translation of this logbook entry: L-344: Ecco a voi il sistema di docking della Sojuz!, by Paolo Amoroso—AstronautiNEWS.

L-343

The Russian Chibis-M equipment to re-adapt the cardiovascular system to gravity after weightlessness. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2013.12.17—I got an overview of Russian countermeasures today. In the ISS world, under the name 'countermeasures' we mean all that we do to minimize the debilitating effect of weightlessness on muscles, bones and the cardiovascular system.

In the countermeasures family, the Chibis-M wins the trophy for the most bizarre piece of equipment I've seen so far!

Here's the problem it's meant to counteract: in weightlessness body fluids, in particular blood, are not pulled towards the legs by gravity as they are on Earth. We call this phenomenon fluid shift and it's the cause of the puffy face and the chicken legs that astronauts typically display when they are on orbit.

When astronauts return to Earth, the effect of gravity can wreak havoc with their cardiovascular system. Here's where Chibis-M comes in. Don it, make a tight seal around your waist and then reduce the pressure around your lower body, causing some reverse blood shift towards the legs. Do it repeatedly in the weeks before landing and, the thought goes, you'll have trained your cardiovascular system to better withstand the return to the Earth, where things have a weight.

And if it doesn't work, nobody will be able to say that you didn't give it your best try!

Italian translation of this logbook entry: L-343: Ecco il bizzarro Chibis-M per voi!, by Paolo Amoroso—AstronautiNEWS.

L-342

Samantha Cristoforetti in Sokol suit in the Soyuz simulator in Star City. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2013.12.18—One final Soyuz sim today with Terry and Anton before Terry and I leave Russia for the Christmas holidays.

Our scenario started today just prior to undocking for reentry to Earth. Before we could open the hooks and release the Soyuz from Station, we had to perform a suit leak check, to make sure that our pressure suits would save our lives in case of depressurization.

In the picture, just left of my left elbow, you can see our pneumatic connections to Station. The big line is ventilation, meaning that it's just cabin air circulated in our suits. The smaller one is the supply of pure oxygen.

For a leak check we close the blue regulator just below the helmet and start supplying oxygen into the suit by opening the valve next to the window. On the arm we have a pressure gauge: if the suit reaches 0.1

atm and then from there 0.35 atm of overpressure within 90 seconds, the leak check is passed! We reopen the regulator and relief the extra pressure into the cabin.

The regulator then remains at the setting 0,4 atm throughout the flight. In a normal day, the suit is simply connected to the outside, but should the pressure in the cabin drop, the regulator will not allow the pressure in the suit to decrease below 0.4 atm.

It's not easy to work in the suit at that pressure: freedom of movement and dexterity are very limited. That's why for a maximum of 5 min we are allowed to change the setting to 0,27 atm if there's a need to work demanding procedures. This pressure makes the suit softer and less bulky, but it's also unfortunately too low to ensure that we'll have no issues with decompression sickness, hence the time limit.

As always in spaceflight, and maybe in life in general, it's a compromise!

Italian translation of this logbook entry: L-342: Abbiate fiducia nella vostra tuta spaziale, ma fate lo stesso un controllo di tenuta, by Paolo Amoroso —AstronautiNEWS.

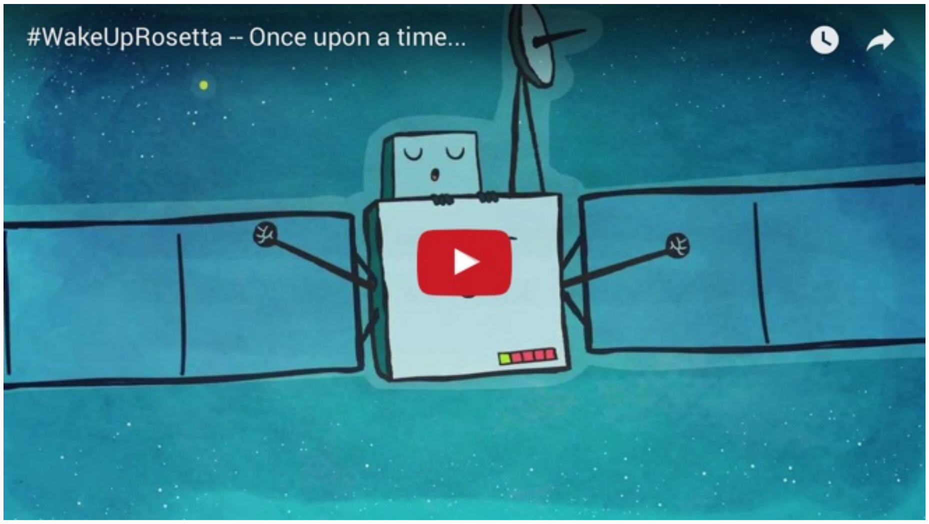
L-340

Vista dell'artista della sonda cometaria Rosetta dell'ESA. Credito: ESA - J. Huart

Star City (Moscow, Russia), 2013.12.20—Early wakeup call this morning at 5am to drive to airport and catch my flight from Moscow to Frankfurt. Training is done and dusted for this year, I'll resume on January 13th.

Talking about wakeup calls: in exactly one month ESA colleagues will send a wakeup call hundreds of millions of km into deep space. Waking up from a three-year long nap will be Rosetta, the comet chasing probe. No kidding: Rosetta will catch up with comet Churyumov-Gerasimenko and the Philae lander will hop on the comet. What a day it will be for our human quest for knowledge!

It's been an amazing space adventure so far: check out a fun recap of Rosetta's journey up to now:



Video: #WakeUpRosetta -- Once upon a time… (2:13)

Yesterday Terry, Anton and I had a manual docking sim together. Usually Anton and I practice that separately, so this was an occasion to see how we would approach this situation as a crew. But we also took some time for a shout-out to Rosetta - granted, my Vine skills need some honing, but it was in good spirit.

I'm sure you can do better, though. Upload your #wakeuprosetta video here - it's cool and it's a chance to win some cool prizes!

That's all from this Logbook for this year. Catch up with you in 2014… wait, did I say 2014? That's the year I'm going to space!

Thank you all for your interest and support so far. Merry Christmas!

Italian translation of this logbook entry: L-340: Alzarsi presto per lasciare Star City e svegliare Rosetta fra un mese!, by Paolo Amoroso—AstronautiNEWS.

L-302

Samantha Cristoforetti's Futura mission logo. Source: ESA / ASI

Cologne (Germany), 2014.01.26—Time to hit the road again and get back to training. The break in this logbook was a bit longer than planned, sorry! Training schedule for the year was reshuffled and so I'm heading to Star City only today.

Just took a look at my train ticket to the airport. Return home: March 28th. In between I will go once around the world: four weeks in Moscow, then Eastward to Japan for two weeks, then on to Houston in March. End of March back here for training at the European Astronaut Centre.

And this won't be my last round-the-world trip this year. Only ten months left to launch and it will be a marathon: nice and steady all the way to the launch pad.

In between Terry, Anton and I will serve as backup crew for Maxim, Reid and fellow Shenanigan Alex. Full sequence of qualification exams, quarantine in Baikonur and then, if all goes well, we'll watch them blast off on May 29th. Six months later, our turn! An exciting journey with lots of marvelous people and I hope you'll come along.

As you know, the mission now has a name, Futura: a beautiful reminder that we're building together a future for us human beings in space. As of Wednesday last week, Futura also has a logo, that I will proudly wear on my flight suit. Thanks to Valerio Papeti for submitting the winning concept.

Training logbook officially restarts tomorrow. Today I want to thank the people who volunteer their time to make this logbook accessible to friends who don't read English quite yet: thanks to Paolo Amoroso and the good folks of the AstronautiNEWS community for the Italian translation. Thanks to Anne Cpamoa and @Intervidia for the French and Spanish translations!

There is no special agreement with these friends: they see the posts when they're published and sometimes translations appear so quickly that I wonder if they read my mind remotely and know in advance what I will write.

Thank you, you guys rock!

Italian translation of this logbook entry: L-302: Un viaggio intorno al mondo, una prova generale e un ringraziamento, by Paolo Amoroso—AstronautiNEWS.

L-301

Samantha Cristoforetti in the manual simulator of Soyuz with her instructor Dima. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.01.27—An easy first day here in Star City. Thanks to my scheduler for the start at 11:00, which gave me a chance to sleep in after the late night arrival from Europe and gradually adjust to the three-hour sleep shift. Three hours is not much, granted. But since I'm a good candidate for having the most rigid internal clock ever observed in a human, I'll take any help I get.

Fun day, also. Four hours at the controls of the Soyuz, first for some manual rendez-vous practice and then for some manual descent training. In the picture you can see where we practice manually flying the descent profile: the control panel and the bluish hand controller are just like the ones we have in the actual Soyuz.

Dima is the super awesome instructor assigned to our crew. He's not only responsible for our manual reentry skills, but also for preparing us for the overall Soyuz qualification exams. He's the one who comes up with the craziest failure scenarios to make us grow as a crew and make sure that we take good care of the Soyuz-TMA 15M later this year.

About manual reentry: in case you missed it, this older logbook has some general words. But don't hesitate to ask any questions!

Italian translation of this logbook entry: L-301: Il rientro manuale della Sojuz e il nostro magnifico istruttore Dima!, by Paolo Amoroso—AstronautiNEWS.

L-300

Samantha Cristoforetti trains to the ATV rendezvous in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.01.28—Sasha and I had a chance today to dive back into the ATV* world today.

There's a dedicated simulator here in Star City in which we can practice rendez-vous scenarios and keep up our proficiency, after the initial course we had at the European Astronaut Centre back in Cologne. As the backup crew assigned to the rendez-vous of ATV5 this coming summer, we need to be as good at it as the prime guys, the other two Sashas (one being my fellow shenanigan Alexander Gerst).

The Russian Penguin suit. Source: Samantha Cristoforetti

I also had an overview class on the Penguin suit. Here's a picture.

Russian doctors recommend that we wear it for several hours a day during the last month on ISS. It has a number of chords that apply a compression load between shoulders and pelvis: the purpose is to re-compress the spine, after the long exposure to weighlessness has caused it to elongate. In addition, you can adjust the tensions on the different chords in such a way that, in order to maintain posture, you need to work "against the suit" and train those little stabilization muscles that we use unconsciously on Earth but get quickly deconditioned on orbit.

Now time for some Soyuz manual docking practice!

*If you're not familiar with ATV at all, here are some general words from an older logbook.

Italian translation of this logbook entry: L-300: Prepararsi all'ATV-5 giusto in caso e la tuta Penguin, by Paolo Amoroso—AstronautiNEWS.

L-299

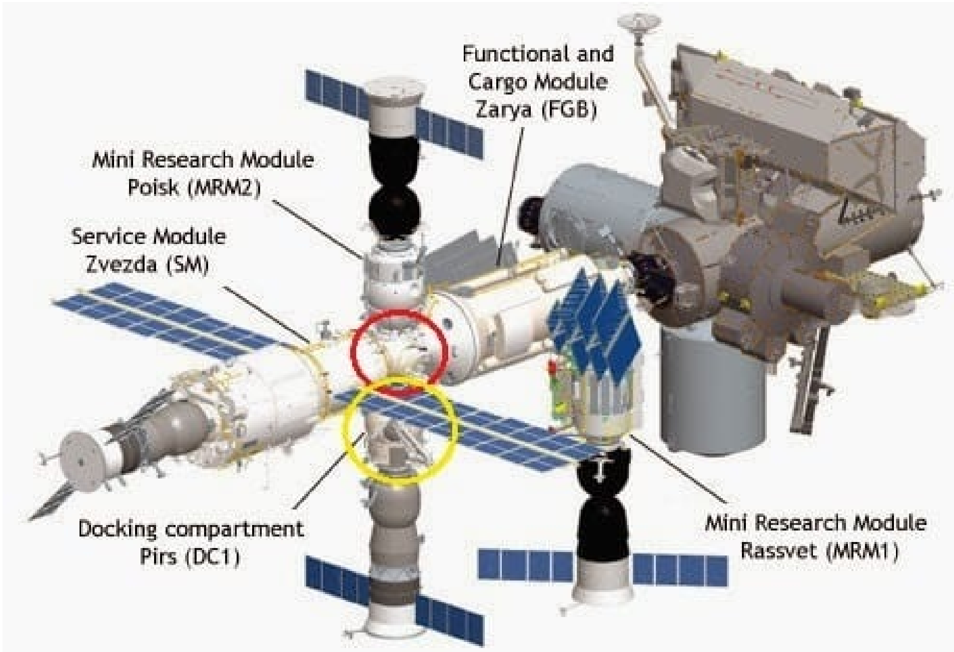
Samantha Cristoforetti and Alexander Gerst in Orlan suit for EVA training in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.01.29—My fellow Shenanigan Alex and I had the pleasure of meeting one of our Orlan instructors again. It's incredible, but it's been almost almost a year and a half since he taught us about the Russian spacewalks suit!

This time it wasn't about preparing us to do an Orlan spacewalk (EVA), but rather to teach us how to be the so-called "third operator", the person assisting the spacewalking crewmembers with pre-EVA and post-EVA procedures.

You may wonder why we would be fulfilling that role, since there is always a third Russian crewmember on-board and he/she is bound to have a lot more training in the Russian procedures. Well, the thing is that this person would most likely be isolated in his/her Soyuz.

If you take a look at the picture I've attached, it will all make sense.



The Russian section of the ISS. Source: NASA

In the yellow circle I've indicated the module which is used as airlock, meaning the module that is isolated from the rest of the Space Station and depressurized, before spacewalkers open the hatch and exit. When spacewalkers come back inside and close the hatch again, before connecting the airlock again to the rest of the Station we verify that there is no leak to the outside. Imagine, for example, that we damaged the hatch and could not close it properly any more: if we reconnected the airlock to the rest of the ISS, we would depressurize the entire Station!

So, Russian EVA procedures foresee a solution for this contingency: the two spacewalkers would get into the small module that I have highlighted in red, called Transfer Section (переходный отсек) and basically use that as a contingency airlock.

To protect for this possibility, all four hatches of the Transfer Section are closed and leak checks are performed before the EVA - one of the tasks of the third operator, by the way.

Now, of the six ISS crewmembers, three have their Soyuz docked to MRM2 and three to MRM1 (this latter will likely be the case for Alex and myself).

As you can easily see, the Soyuz that is docked to MRM2 remains isolated from the rest of Station. So, crewmemers of that Soyuz who are not outside doing the spacewalk need to wait in the MRM2/Soyuz volume, because they can not remain separated from their spaceship. And because of the way crews are composed and docking ports are utilized, most likely the third Russian crewmember would be one of those isolated in there.

Hence the need to ask a non-Russian to serve as third operator. Alex and I are an obvious choice, since we've already been certified in performing Orlan spacewalks and we only needed a quick refresher.

By the way, you can see some pictures of our Orlan training a while back here.

Italian translation of this logbook entry: L-299: Isolati nella Sojuz durante una passeggiata spaziale russa? Ecco perché, by Paolo Amoroso—AstronautiNEWS.

L-298

The Soyuz manual flight simulator in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.01.30—A chilly day in Star City today. When I left this morning on my bike it was about -30°C. Luckily it's nice and warm in the Soyuz simulator, where I got some more manual flying practice. In the picture you can see the dedicated simulator we use for this purpose. Inside it looks just like our regular descent module simulator, but it's really specifically designed to present us with all kinds of manual approach and docking scenarios and to project accurate images on the periscope view as we fly. If you missed it, you can see our view and our controls here.

Please, don't think that we can fire the big main engine of the Soyuz with those controllers though. We can only fire the small attitude thrusters: we have two sets of them and we nominally only use one at a time. If the main engine can give an acceleration of ca. 0.4 m/s^2, one set of attitude thrusters only provides about one tenth of that acceleration. But that's plenty, because by the time we are within 400 meters from Station we shouldn't nominally have more than 2 m/s of closing velocity: to come to a full stop from that speed, if needed, we would only need to fire the small thrusters for 50 seconds.

We do practice scenarios in which the automatic control fails and we are way faster than we should be. If we recognize such a dangerous situation, we're required to select both sets of thrusters simultaneously so that we can slow down twice as fast. At that point, it's not about rendez-vous any more, but it's about avoiding a possible collision with Station!

Italian translation of this logbook entry: L-298: Quanto rapidamente potete rallentare una Sojuz in volo manuale?, by Paolo Amoroso—AstronautiNEWS.

L-297

Samantha Cristoforetti and Anton Shkaplerov in the Soyuz simulator in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.01.31—Anton and I spent the afternoon in the Soyuz simulator today, warming up as we wait for our third crewmember Terry to join us in the sim next week.

First we practiced the nominal undocking sequence and a nominal reentry burn, of course with a number of malfunctions. Then we moved on to practicing a ballistic reentry. I have explained in this earlier logbook that it's not a very comfortable way of returning to the planet.

To add a little bit of detail, let's take a look at today's second scenario: we had just left ISS and discovered that we were loosing our atmosphere into space. Pressure in our descent module was decreasing with a rate of 1 mm Hg every 10 seconds. (Yes, the Russian space community loves mm of mercury!)

Our computer was programmed with all the data for a comfortable nominal reentry, but that would have meant turning on the engine to give the braking impulse and reenter the atmosphere only about two hours later! Not a good idea in our scenario to wait that long.

That's where the so-called Program 5 comes in: a predetermined sequence of commands stored in the computer with very generic parameters for the reentry burn. Certainly not enough for a controlled reentry, but enough for a ballistic ride through the atmosphere. The key of course is to start Program 5 at the right time. We have a printed table called Form 23-14 which contains the "magic time" for each and every orbit: Russian cosmonauts print it out every single day on Station and make sure a copy is in every Soyuz, to be prepared in the case of an emergency evacuation!

Of course, in our case things were not so easy. We got a computer failure before the engine burn and we ended up having to do everything manually. But even in that case, Form 23-14 is your best friend: it tells you at what time you need to press the button and manually turn on the engine.

Why is that so important? Well, it's you only guarantee that you will land in a relatively safe area, rather than, for example, in the middle of the ocean or on a Himalayan mountain peak!

Italian translation of this logbook entry: L-297: Come evitare di fare atterrare la Sojuz su una vetta himalaiana, by Paolo Amoroso—AstronautiNEWS.

L-295

Samantha Cristoforetti's winter survival training. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2014.02.02—Happy Sunday everyone!

Here in Star City these past few weeks several crews have done their winter survival training. Some have faced temperatures as low as 30°C as they spent two nights outdoors in the woods!

This has brought back memories of my own winter survival training two years ago. At that time I wasn't assigned to an ISS expedition yet, but I was undergoing training as the ESA reserve astronaut. My "crew" included my fellow Shenanigan Thomas Pesquet and one of the 2009 cosmonaut candidates - now a fully qualified cosmonaut - Sergey, the latter serving as our Commander for the three days we spent outdoors. We had a great time together and we were very lucky with the weather: there wasn't too much snow on the ground and temperatures only dropped to -15°C in the nights!

I have taken some time today to select and upload some pictures, that you can find here.

And if you want to know more about how we spent those two days, here's my account from two years ago.

(Italian translation by @disinformatico here).

Italian translation of this logbook entry: L-295: Quella volta che siamo sopravvissuti all'inverno russo, by Paolo Amoroso—AstronautiNEWS.

L-294

Samantha Cristoforetti at a Russian space food tasting session in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.02.03—I was invited to lunch today!

Between morning and afternoon classes Anton and I had had a food tasting session of Russian space food here in Star City. We were joined by our backup crew: Oleg, Kimya and Kjell. Only our crewmate Terry was missing!

A tasting session of Russian space food in Star City. Source: Samantha Cristoforetti

This is the first of eight "space lunches" in which we'll be invited to try and evaluate the Russian menu. As a European astronaut I will eat primarily the NASA menu and the ESA bonus food onboard, but it's good to know what the Russian colleagues have to offer. I'm sure there's a lot of food trading going on onboard!

A tasting session of Russian space food in Star City. Source: Samantha Cristoforetti

Some of the food rations will be dehydraded, others will be thermostabilized and only need to be heated. Unlike NASA and ESA thermostabilized items, which come in pouches, Russian ones typically come in cans not dissimilar from your typical tuna can from the supermarket.

Italian translation of this logbook entry: [L-294: Un assaggio di quello che offre il menu russo](), by Paolo Amoroso—AstronautiNEWS.

L-293

Samantha Cristoforetti and Terry Virts in Sokol suit in front of the Soyuz simulator in Star City. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2014.02.04—Terry is back in Star City and will join Anton and me for a long Soyuz sim in the Sokol suit tomorrow. In the picture, you can see Terry and myself before a similar sim last December.

We had our two-hour brief today with our instructor Dima. The plan for tomorrow is to have a longer-than-usual sim (five hours instead of four) and go through the full sequence of events from the moment we enter the descent module on the launch pad to docking at the International Space Station.

Sure, in real life it would still take a little bit longer, but in the simulator we can cut away the time in which not much would be happening, since waiting doesn't have a lot of training value.

After ascent and separation from the rocket, things go pretty fast with the new six-hour rendezvous profile. While I conduct the leak checks and verify that all systems are nominal (in the sim they never are!) Anton goes straight into monitoring of the dynamic mode: in fact, the automatic cycle starts a couple of minutes after injection into orbit, no time to waste.

If all goes well, the onboard computer builds its basic LVLH orientation (belly to the Earth and "nose" in the direction of flight), tests the Kurs system and gives two initial burns that raise and correct the orbit. Then there is some time for us to test the manual controls, before we move on to the second sequence of two orbital correction burns.

Then we transition immediately to the rendezvous mode and on we go all the way to docking.

This morning Anton and I already had similar four-hour sim, except that we had an engine failure during the second burn. If that happens, the automatic cycle stops and the quick 6-hours-launch-to-docking profile is not possible any more. Time to take it easy and get ready to spend two days in the little Soyuz, like in the old times!

Photo credit: GCTC

Italian translation of this logbook entry: L-293: Bentornato nel simulatore Sojuz, Terry!, by Paolo Amoroso—AstronautiNEWS.

L-292

Samantha Cristoforetti in Sokol suit in the Soyuz simulator in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.02.05—Today we had long sim with Terry and Anton practicing all operations from the moment we take our seats on the launch pad to docking… well, actually we didn't quite make it to docking, we ran out of time a few km from Station. But it was anyway an intense training day with lots of learning points!

This is, by the way, how our first exam day will look in a couple of months, when we will be do our official qualification sims as the backup crew of the Exp40 folks. On this type of sims, since the exam does foresee that we get to ISS somehow, we would never get catastrophic malfunctions like a fire, a depressurization or a leak in the propellant lines: those scenarios would force us to an immediate emergency reentry.

Instead we will get a number of smaller malfunctions, which today included for example a lack of ventilation in Terry's suit, a leak in one of the oxygen lines, a failure of the main radio receiver, a broken gas analyzer forcing us to manually keep internal pressure within acceptable limits by opening and closing the oxygen supply valve, a series of Kurs failures of both the prime and the backup unit, which would have eventually forced us to a manual rendezvous and docking, if we had gotten that far.

The Sokol suit and knee straps. Source: Samantha Cristoforetti

We don't always wear our Sokol during Soyuz training, but these so called "suited" sims are very useful to get us used to properly strapping in and organizing our actions. As you might have noticed, we don't exactly have a lot of space to move around in the descent module, so it's a really good thing to practice dealing with the suit in the cramped space.

I've attached a couple of pictures in which you can see knee straps. Because at reentry the impact with the ground is pretty violent, it's important that legs are tied down to the seat: if they were free to move, legs might violently impact the control panel just above and cause pretty serious harm. Not having leg straps properly in place has been a serious debrief item in one of our previous sims, so now we are in the habit of checking each other carefully.

Italian translation of this logbook entry: [L-292: Per evitare di farvi male alle gambe quando atterra la Sojuz], by Paolo Amoroso—AstronautiNEWS.

L-291

André Kuipers in front of the ATV control panel on the ISS. Source: NASA

Star City (Moscow, Russia), 2014.02.06—Today Sasha and I passed our ATV rendezvous exam and were officially certified to perform the monitoring of the ATV docking.

As you probably know, the Automated Transfer Vehicle is totally autonomous in its approach and docking to the International Space Station. In fact, there is no way to take manual control of ATV and bring it in for docking, as our Russian crewmates can do with the Progress cargo ship.

But we do have humans in the loop: with the help of the camera and a number of visual cues and overlays, plus extensive telemetry information from the vehicle, the crew can monitor the approach and make sure that ATV remains within the nominal approach parameters in terms of speed, corridor, orientation.

We are expected to recognize and react within a few seconds to a number of possible deviations that can require us to command the ATV to retreat, escape or abort. A retreat is a less severe intervention that just sends ATV back to the previous hold point. An escape and an abort are instead serious disengage maneuvers that bring ATV to a safe distance and position with respect to Station for troubleshooting and a possible reattempt in the next days.

In the picture you can see ESA astronaut André Kuipers in front of the ATV control panel - yes, the big red button sends the abort command.

Here you can see a few pictures from today's exam.

The prime crew, including my fellow Shenanigan Alex, also passed their exam today!

Italian translation of this logbook entry: L-291: Oggi passato l'esame sull'ATV!, by Paolo Amoroso—AstronautiNEWS.

L-288

The Russian device Braslet. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.02.09—The weekend is almost over here in Star City and it's time to get ready for another training week.

Looking back at last week, we wrapped up the training on Friday with a long simulation session in the Russian segment mockup reviewing crew response in case of a depressurization. This review will come in handy next week, when we'll do this training in the vacuum chamber, with actual "leaks" and real pressure drops across closed hatches. I'm very much looking forward to experiencing this!

Last week I also had an interesting session on the tilt table with the purpose of conducting a fit check for the Braslet (Браслет). This item was first introduced to me last summer, together with a number of Russian clothing and personal hygiene products. It was then that my thigh measurements were taken in order to produce my personal Braslet, that will fly with me on the Soyuz.

The idea is pretty simple: you have an anatomically shaped strap that you can tighten around your upper thigh to restrict venous blood flow from the legs to the upper body. This is used in the first days of spaceflight to help in the adaptation to weightlessness conditions, in which there is an uncomfortable fluid shift towards the head.

The big numbers you can see in the picture are a scale that allows you to tighten the Braslet to a specified value, which is determined pre-flight. That's when the tilt table comes in: by tilting a person head down you can simulate the weightlessness-induced effect of blood rushing to the head.

To have an objective measurements of the effect of the tilting on my circulatory system, sensors were applied around my head. First I was tilted a few times between 50° head-up and 50° head-down. Then, once the specialists were satisfied with the baseline data, they helped me put on the Braslet. We went through a couple of iteration steps to find out how much I should tighten it to have the expected effect. And the effect was quite significant. I realized it when the Braslet was removed: I was still tilted back 50° and, as soon as the strap was released, I could immediately feel the blood rushing to the head.

The tilt bed is also used in Baikonour for pre-launch conditioning, as you can see in this picture with ESA astronaut Paolo Nespoli.

Italian translation of this logbook entry: L-288: Braslet, ovvero perché stringersi una cinghia attorno alla coscia, by Paolo Amoroso—AstronautiNEWS.

L-287

Samantha Cristoforetti and Alexander Gerst in the Orlan airlock simulator in Star City. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2014.02.10—Today I have spent the morning in the Orlan airlock ops simulator in Star City with fellow Shenanigan Alex, putting into practice what we learned last week about supporting a Russian EVA in the role of third operator. If you missed it, you can read a bit about that on this logbook.

Our Soyuz commanders, Anton and Maksim, were in the Orlan. The airlock ops simulator is one big room, it doesn't have separate sections to reproduce the different modules of the Station. But it does have regular hatches, valves and pressure indicators, which is what we would work with during pre- and post-EVA operations. There is of course no change in pressure in the room, but all pressure gauges react according to our manipulation of the valves.

Here you can see a panorama of the simulator room.

And here's Anton closing the hatch "to space", the beginning of our repressurization and post-EVA procedures.

Also, here you can see pictures from some time ago when Alex and I went through the airlock training in the Orlan.

Italian translation of this logbook entry: [L-287: Operazioni nell'airlock Orlan con Alex e Anton](), by Paolo Amoroso—AstronautiNEWS.

L-286

Mockup of modules of the Russian segment of the ISS in Star City. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.02.11—A trip to the vacuum chamber today! A big vacuum chamber that contains a replica of a few Russian segment modules, including the Service Module and the Soyuz. As we were inside these module, pressure was dropped in the chamber around us: the chamber technicians had then the possibility of opening one of several valves connected the atmosphere of our module to the rest of the chamber, thus creating "leak" conditions in various modules.

All the hatches are just like the ones in space and the idea is to practice response procedures for the case of a leak, a so called rapid depressurization scenario. We have practiced those procedures many times both in Houston and in Russia, so we know very well how to react if the pressure starts dropping inside the Station, which we could notice because the alarm goes off or simply because our ears start to pop, whichever comes first - unless of course you happened to be staring at a pressure gauge, in which case you would see the needle moving.

The main point of the response procedure is to determine which module is leaking, which involves closing hatches in a specified order. Once you close a hatch you check your pressure gauge: if the needle stops moving, the leak is on the other side and viceversa. And you keep on going until you've found the culprit, which then you have to isolate.

Today we practiced again this kind of work, with the difference that we actually had a pressure differential building across the hatches when we had them closed. It was very interesting to see that effect and to realize how hard it can become to open a hatch that, say, swings open towards you, when there is a leak on the other side and you have to pull against a pressure differential. To avoid problems reopening a hatch, we are instructed to leave a hatch closed at most for half the time it takes for the pressure to drop 1 mm.

Unfortunately I was not allowed to take pictures in this facility. I have attached a picture of the regular Russian segment mockup we practice in Star City. Progress, Service Module, FGB, DC1 are all in place. The MRM1 and MRM2 are off to the right and to the left you can see the future modules MLM and UM.

Here you can navigate the panorama if you like.

Italian translation of this logbook entry: L-286: Oggi calo di pressione!, by Paolo Amoroso—AstronautiNEWS.

L-285

Samantha Cristoforetti and the crew of the Soyuz TMA-15M at the debrief with the instructor after a Soyuz simulation. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.02.12—Today Anton, Terry and I were back in the Soyuz simulator for a pretty dense training day.

We started out with the approach profile to ISS and lost the Kurs system - the antennas that orient us to Station - just before the last burn on the main engine. If that happens, the compuer will still give you that burn based on the last good state vector it had from the Kurs. Basically, since it knows the position and velocity at the moment of the Kurs failure, it can propagate the state vector to the future and still calculate the burn.

However, propagating the state vector without the possibility of correcting it with the antenna measurement leads to errors that accumulate as time passes. That's why, after that final burn and within 3 km from ISS, the computer stops working the approach profile and we, as the crew, are on our own. No big deal, since we're trained for manual approach and docking.

As Anton was bringing us in manually, just a few minutes from contact, the computer also failed completely. Not that it mattered much at that point, so close to arrival, except that…

just after docking we realized we had a leak in the Soyuz! we ended up rushing to undock again and then we had to organize an emergency descent fully manually: Program 5 dies with the computer! By the way, if you missed it, you can read about Program 5 in this previous logbook.

A training session never ends when we leave the sim, of course. After a quick break, it's debrief time, as you can see in the picture. Together with our instructor Dima we go over the events, especially any mistakes or actions that could have been done better or differently, so that we can try to perform better next time!

Italian translation of this logbook entry: L-285: Una di quelle giornate in cui si guasta tutto, by Paolo Amoroso—AstronautiNEWS.

L-282

Samantha Cristoforetti tests the Sokol flight suit at an overpressure of 0.4 atm at the Svesda facilities. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.02.15—Remember when I went to Svesda last October to take the measurements for my Sokol suit and to make the mold of my seat liner? [If you don't, you can check the Logbooks L-426 and L-415].

Neck pressure control. Source: Samantha Cristoforetti

Well, last week it was time to go and check out the custom-made items that will fly to space with me!

It's been pretty special. Of course, being in training to fly to space is something extraordinary every day. But there are things that make you feel closer to the actual spaceflight, that make it all more real: trying on the space suit that I will wear on my way to ISS and back was definitely one of those moments.

We started the day with an initial evaluation of the seat liner, both without the suit and with the suit. In the picture you can see the specialists feeling behind my neck, to make sure I had continuous contact. It's very important at landing impact to distribute the load evenly all along the spine and the neck.

Then the specialists had me sit in a special suspended seat and determined my exact center of mass when curled up in the position that I will assume in the Soyuz. That information is passed on to the ballistics group, so that they can calculate the overall center of gravity of the vehicle.

The determination of the center of mass. Source: Samantha Cristoforetti

Then we moved on to evaluating the Sokol at the overpressure of 0,4 atm, meaning in the condition that we would have in case of a depressurization of the Soyuz. Bear in mind that this is an emergency situation. Other than a spacewalking suit, the Sokol is not designed for you to work in this condition: it's designed to give you maximum dexterity and freedom of movement when not inflated and to save your life in case of a depressurization.

Neck pressure control. Source: Samantha Cristoforetti

Since it's a soft shell, it gains significant volume at 0,4 atm overpressure: it become bulky, rigid and way bigger than your size, so that for example you need to lift your spine up if you want to keep your hands in the gloves. The expansion also leads to your lower torse hanging off your knees. In fact, the back of the knees is typically the most critical spot in terms of possible pain and circulation issue. But if the suit is well sized, there is enough space to actively offload some of that weight, alternating the two legs.

The opening of the regulator at the end of the overpressure test. Source: Samantha Cristoforetti

We test the suit in this condition for two hours: that is the maximum time that the crew would need to return to Earth with an emergency reentry after determining that the Soyuz is leaking. I didn't have any significant issues with the suit - most small people like me don't. Still, I was happy when the test was over and I could reopen that regulator!

Italian translation of this logbook entry: [L-282: Sotto pressione!](), by Paolo Amoroso—AstronautiNEWS.

L-280

Sokol suits waiting to be worn for a Soyuz simulation. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2014.02.17—Some more manual flying of the Soyuz today and then a preparatory session for tomorrow's Soyuz sim with the Sokol suit.

On comments from last week's posts, I have been asked how you don the Sokol. Indeed, when you see all zipped up, it's not so obvious where the entry is!

So, here it is: a step by step pictorial guide on how to put on your spacesuit! See the captions of each photograph for the corresponding explanations.

The suits before being worn.

Here is how the Sokol suits look when they're "empty" and ready to be donned. As you can already see, the entire front part of the torso is opened and that's how you get it on.

Wear the lower part.

First you slide your feet through the opening and don the lower part of the suit.

Thread your arms.

Then you slide your arms in.

Pass the head through the neck ring.

Then comes the tricky part, passing the head through the neck ring. I have been a bit spoiled during my training sessions, because the Sokol suits I got were typically a bit big for my size and that makes this maneuver a lot easier. When I put on my custom-made suit last week, I had to work a lot harder. You need to make sure that the back side of the suit is as stretched as possible and then you need to tuck in your head while you push the neck ring forward. Tricky at first, but after some practice it's not so hard.

The front is still open.

After passing the head throught the neck ring, this is the status. You still have the front part completely open and the internal membrane is loose.

Connect the communication headset cable.

After donning your com cap, you pass the cable through the neck ring and then connect it inside of the suit.

Fold the inner membrane.

Then you carefully fold the internal membrane of the suit and wrap two elastic bands very tightly around it.

Close the abdomen part.

You close up the abdomen part of the suit.

Close the zipper on the top.

Then you zip close the upper part.

Ready!

And ready you are! If it's a warm day, you might connect the ventilation hose to a portable ventilator to keep cool before you connect to the ventilation system in the Soyuz (or, more often, the Soyuz simulator).

Photo credit: Gagarin Cosmonaut Training Center, Samantha Cristoforetti

Italian translation of this logbook entry: [L-280: Manuale di istruzioni per indossare una tuta spaziale], by Paolo Amoroso—AstronautiNEWS.

L-279

Samantha Cristoforetti performs a tightness check of the Sokol suit in a Soyuz simulation. Source: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.02.18—Quite intense Soyuz sim this morning with Anton and Terry, dealing with a fire in the Soyuz descent module.

Our scenario started just before undocking from ISS. First we performed, as usual, a leak check of the hatch, followed by a leak check of our Sokol suits. That's what we were doing in the picture, by the way, as you can maybe tell by the inflated suits. If you missed it, you can read more about leak-checking the Sokols in this logbook entry.

Just after we detached from Station, we started seeing smoke coming from the control panel. We immediately closed the helmets and turned off ventilation in the suits, to avoid circulating toxic combustion products. At the same time we opened the appropriate valve to supply oxygen to the suits from our oxygen tanks.

We turned off all electric equipment, but of course in our simulation that didn't kill the fire: we had to prepare to vent all our atmosphere to space. And rather quickly: with oxygen flowing into our suits and then out into the cabin via the regulator valve, the oxygen percentage increased quickly, getting close to that 40% that is considered a flammability hazard.

When times are rushed like this, Anton and I work in parallel different procedures. In this case, I would work the depressurization of the cabin, while he would start Program 5 to get the Soyuz oriented and ready for the reentry burn. However, the day had another surprise for us: my control display failed. Having only one display left forced us to work procedures in sequence, instead of in parallel. Needless to say, we were rushed.

Our infrared sensors also failed, which means that Anton had to orient the Soyuz manually and, having his hands busy, could not send any commands or change format on his display. That's when I tried a little tool I had never used before: a small "remote control", with which I could move the cursor on Anton's display and send the "Enter" command. Not the fastest way, but it worked for us today!

Italian translation of this logbook entry: L-279: Quando avete un incendio e vi è rimasto un solo display di controllo, by Paolo Amoroso—AstronautiNEWS.

L-278

Samantha Cristoforetti in a Soyuz manual docking simulation. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2014.02.19—One of the good things about being an astronaut is that you can lie down on your back all day and call it training. Today I spent eight hours lying down in a Soyuz seat: first for a four-hour sim, then for manual docking and finally for manual descent. This latter we usually train in a regular seat, but this week the control panel is installed in the centrifuge for the exams of the next departing crew, just like it happened back on L-423.

For our last simulator session on this training trip to Star City Anton, Terry and I flew a couple of times the rendezvous with ISS: one time based on the four-orbit quick rendezvous and one on the old two-day profile. The first crews that flew the new, fast scheme last year actually had to pass exams in both. Now the quick rendezvous has officially become the nominal mode, so we will have only one exam on ascent and rendezvous and we will play it just like on a real day: we will start out with the four-orbit profile and we'll be ready to transition to the two-day backup plan if a malfunction forces us to do so. That could be an issue with the computer, with burns or with the determination of the state vector from the ground - or really any issue, big or small, that Moscow wants to have some time to work on before sending us on a trajectory towards Station.

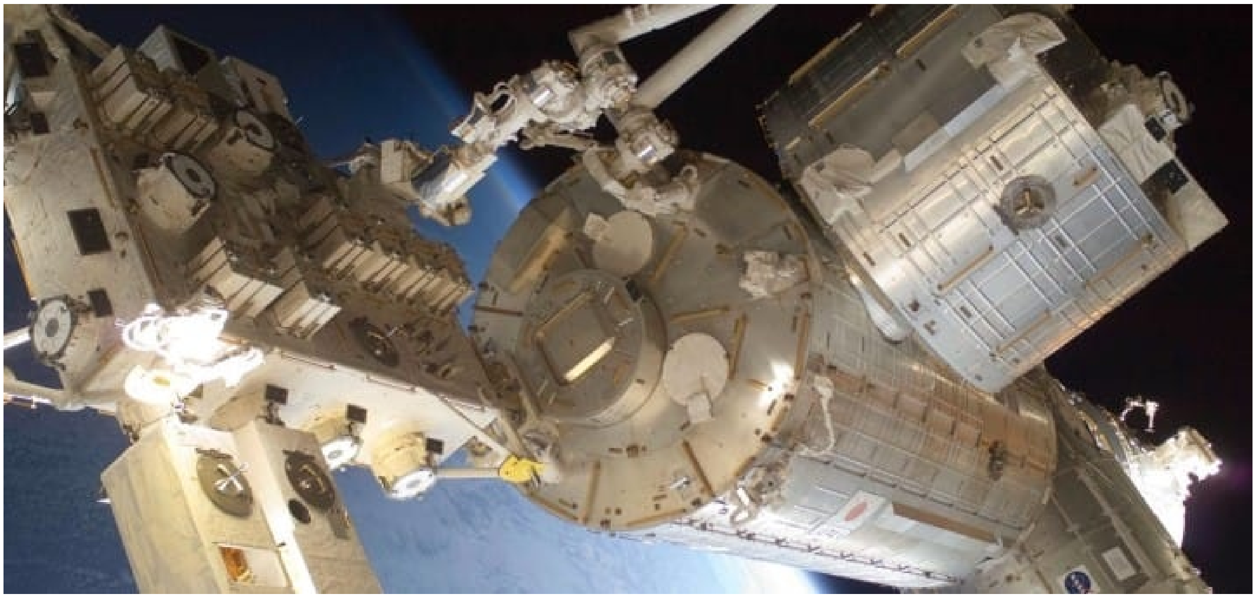
So, that wraps up this trip to Star City. Incredibly enough, next time I'll be in Russia it will be for some final training and then the certification exams as the backup of Maksim, Reid and Alex. And after that I'll go to Kazakhstan to see those guys launch - and to be ready for the extremely unlikely event that we have to launch in their place. I can't believe it's coming so soon.

I'll miss flying the Soyuz in the next six weeks, but I'll have other interesting training keeping me busy in Tsukuba, Houston and Cologne. Next logbook from Japan on Monday!

Photo credit: GCTC (Manual docking)

Italian translation of this logbook entry: L-278: Vita da astronauta: passare la giornata sdraiati e chiamarlo addestramento!, by Paolo Amoroso—AstronautiNEWS.

L-273



The Kibo laboratory of the ISS. Source: NASA

Tsukuba Space Center (Tsukuba, Japan), 2014.02.24—I'm in Japan this week for training at the Japanese Space and Exploration Agency (JAXA), in particular at the facilities located in Tsukuba, a university and science city not far from Tokyo.

As you certainly know, JAXA is an important partner of the ISS program. In the picture you can see JAXA's significant contribution to Station: the Japanese laboratory JEM, also known as Kibo, with the smaller stowage module JLP attached to it. JEM also has a magnificent balcony, the JEM Exposed Facility (JEF) and even its own robotic arm, the JEMRMS (JEM Robotic Manipulator System).

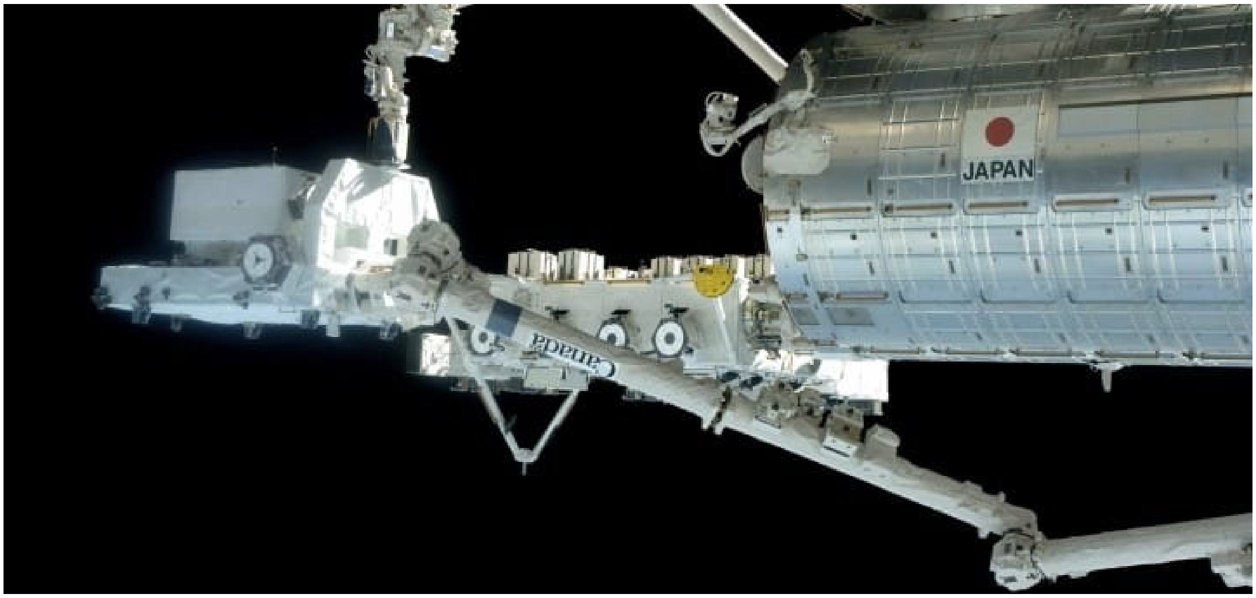
Terry and I are here to complete our training flow on JEM systems and JEMRMS and to prepare as backups of Expedition 40/41, i.e. Alex and Reid. That includes training on their experiment complement, but does not include HTV training, since the Japanese cargo vehicle is not scheduled to be on ISS during their increment. Who knows, we might still get an HTV in our prime increment. In that case we'll get the training next summer, when we'll be back for a final Japanese trip.

Today's training day was mainly dedicated to a review of the JEM systems, which I badly needed, since I got my initial JEM training in August 2012. I also had some additional classes ECLSS tasks - that's the Environmental Control and Life Support System.

Some of those tasks might sound trivial, but it's vital to perform them accurately if we want to have a good living environment on Station. One of the tasks that you really don't want to mess up on orbit, for example, is measuring the velocity of air flowing through inlet/outlet grids in the ventilation system. We do that periodically with a dedicated air flow measurement tool. Why? Well, flight controllers on the ground have models of how that velocity field should look like. If the flow velocity becomes significantly smaller, there is a clogging issue in the ventilation ducts and it is necessary to… well… vacuum clean. Vacuum cleaning of the exposed grids is a weekly housekeeping task. But based on velocity measurements the ground might schedule a vacuum cleaning activity that requires you to open panels or tilt racks. Depending on the location affected, that can become a labor-intensive task, and certainly not a glamorous one. But that's how we keep proper airflow in the ventilation ducts on Station.

Italian translation of this logbook entry: L-273: Capire quando è il momento di passare l'aspirapolvere, by Paolo Amoroso—AstronautiNEWS.

L-271



Kibo's robotic arm working with the Canadarm2 of the ISS. Source: NASA

Tsukuba Space Center (Tsukuba, Japan), 2014.02.26—Training in Japan continues, in parallel to plenty of cultural experiences for Terry and myself. For example, yesterday our Japanese colleagues Soichi and Kimiya took us out during the lunch break to try the traditional savory pancake "okonomiyaki". Very tasty!

We've had more JEM training, in particular on the thermal control system and on some maintenance tasks. To practice one of those, the change-out of the HEPA filter in the ventilation ducts, we got to go to the clean room. This is one really unique feature in Tsukuba: classroom, JEM and airlock mockups, robotic simulator and even mission control and clean room are very close to each other!

Today we got a refresher class on the JEM RMS, the robotic arm that is installed on the JEM Exposed Facility and is controlled by astronauts from the JEM. You can see it [in the picture](#) in a collaborative task with the SSRMS, which is the bigger Station robotic arm, also known as

Canadarm2.

We get a lot of training in flying the SSMRS. Since the JEM RMS is quite similar and its operational envelope limited to the Exposed Facility area, we don't need a lot of extra training on it. But we do have to become familiar with all the specificities in nomenclature, procedures and control interfaces, as well as with the physical environment in which JEM RMS operates and with the camera views that are available to monitor movement and clearances to structure.

Picture by Expedition 20. Credit: NASA

Italian translation of this logbook entry: L-271: Okonomiyaki e il braccio robotico giapponese, by Paolo Amoroso—AstronautiNEWS.

L-270

The Exposed Facility of kibo. Source: NASA

Tsukuba Space Center (Tsukuba, Japan), 2014.02.27—Today Terry and I had some introductory classes on the JAXA payload racks, which provide resources to run different types of experiment in the microgravity environment of ISS.

One of the racks is Saibo, which means "living cell" in Japanese. Just like the Biolab rack in ESA's Columbus laboratory, Saibo provides an environment to run life science experiments, for example involving plants or cell cultures.

The temperature, humidity and CO_2 content of the atmosphere are controlled and continuously monitored. Saibo, just like Biolab, also includes a centrifuge: in this way, while part of the samples are exposed to weighlessness, a 1G control group can be put in the centrifuge, which recreates the "weight" conditions of Earth.

In the afternoon Terry and I had a very interesting robotic simulator in which we practiced the interaction with Tsukuba mission control with an actual J-COM, the Japanese capcom. Tami, our J-COM today, could count on the help of a JEM flight controller (J-Flight) and a JEM robotic controller (KIBOTT). That was especially important when we ran into malfunctions that caused the arm to stop.

In our simulation today we practiced the relocation of an external payload from one location to another on the Exposed Facility. In the picture you can see how a typical payload looks: it's the element sticking out to the left and towards the solar array (although the array is really far behind).

Italian translation of this logbook entry: L-270: Operazioni robotiche con i controllori di volo, by Paolo Amoroso—AstronautiNEWS.

L-269

The release of a CubeSat group from Kibo on the ISS. Source: NASA

Tsukuba Space Center (Tsukuba, Japan), 2014.02.28—Very timely class today for Terry and myself at JAXA. Just a few hours ago on ISS a last group of CubeSats was deployed by the Japanese robotic arm (JEM RMS) and we got trained today just on that: crew operations in support of such deployments.

In fact, it seems that the JEM RMS will be busy launching nanosatellites in the coming years. It's a great way to put small, relatively simple hardware on orbit at an affordable price!

So, how are the nanosatellites deployed? They arrive to ISS on a cargo vehicle, mounted in an assembly that includes not only the satellite itself, but also the deployment system: as far as I understand, that's a simple spring-loaded mechanism.

The task of the astronauts is to mount the satellite/deployment system combination on a dedicated platform, that can be grappled by the robotic arm. As you can see in the picture, the arm then moves into a release position - one that makes sense from an orbital mechanics point of view - and the release system is activated. In an instant, the nanosatellites are on their way to do whatever job the designers constructed them for.

You might be asking yourself now how the platform with the satellites get outside of ISS to be grabbed by the JEM RMS. Well, the JEM has this really cool piece of hardware: an actual airlock. Crewmembers attach the platform with the satellite to an interface, which is mounted on a slide table. Slide the table into the airlock, close the internal hatch, depress the airlock, slide the table out onto the JEM Exposed facility; then release the platform from the slide table, but only after the JEM RMS has grappled it.

After the satellites are on their way, the JEM RMS brings the now empty platform back to the slide table, so that it can be brought back inside, ready for the next batch of nanosatellites.

Picture: NASA

Italian translation of this logbook entry: L-269: Come gli astronauti supportano il rilascio dei CubeSat, by Paolo Amoroso—AstronautiNEWS.

L-266

Moving the Kibo Deck 1 rack to inspect a faulty cooling pump. Source: NASA

Tsukuba Space Center (Tsukuba, Japan), 2014.03.03—Today Terry and I were joined by my fellow Shenanigan Alex in a class on planned in-flight maintenance tasks.

Actually, although Alex just arrived in Japan, I guess you could say that it's the two of us who joined him: as his backup crew, we learned about the maintenance activities that are planned for Alex' increment this summer.

One of the most important ones is the likely replacement of a cooling pump inside the Japanese laboratory JEM. Like the other modules, JEM has two cooling loops set at different temperatures: the LTL (Low Temperature Loop) and the MTL (Medium Temperature Loop). Each loop has its own pump to circulate the cooling water and nominally the loops are separate.

However, the JEM LTL pump has been misbehaving lately.

Troubleshooting is ongoing and the loops are currently connected, with water being circulated by the MTL pump only. Although all operations in the JEM can be run nominally, this is a rather uncomfortable condition to be in, because there is no redundancy. A replacement of the LTL pump with a spare might become necessary.

As we learned today, the most complicated thing in this operation is the rotation of the Deck1 rack to gain access to the pump. In the recent snapshot from the onboard camera you can see the rack rotated to allow the ongoing troubleshooting efforts. What makes it quite time-consuming is that a number of ventilation ducts running between the rack and the endcone need to be disconnected at somewhat hard-to-reach locations. Sometimes being a good astronaut is about finding the right body position to reach a bolt in a tight space!

Italian translation of this logbook entry: L-266: Quando le cose si rompono: la possibile manutenzione di una pompa, by Paolo Amoroso—AstronautiNEWS.

L-265

Samantha Cristoforetti and Terry Virts examine a training model of the Protein Crystallization Research Facility (PCRF) of Kibo. Source: ESA/Corvaja

Tsukuba Space Center (Tsukuba, Japan), 2014.03.04—Last day of training at the Japanese Space Agency JAXA for me and Terry. Among many other things, we were trained on the Protein Crystallization Research Facility (PCRF) in the JEM laboratory.

The purpose of the PCRF is to take advantage of the microgravity conditions on ISS to produce large, high-quality protein crystals, that are then returned to Earth for x-ray diffraction analysis.

Unless you're familiar with the topic, you're probably wondering why we care about protein crystals. I certainly did, before it was explained to me today. So, here's what I understood.

We care a lot about proteins. Everything that happens in our body is regulated by proteins - about 100.000 different ones, continuously assembled in our cells according to the instructions coded in our genes.

So, when researchers on Earth try to develop a drug that will cure a certain disease, one approach is to find out what relevant proteins are involved and how they function: drugs can then be developed that specifically target those proteins.

The good thing about proteins is that their function and their structure are closely related: figure out their structure and you'll have learned a lot about their function. The other good thing about proteins is that we know how to make them grow into a crystal structure, in other words into a highly ordered arrangement of molecules. And the next good thing is that we have a great technique, X-ray diffraction, to analyze the structure of those crystals.

Now bring the ISS into the equation, a facility that provides long-term exposure to microgravity conditions. The protein crystals we can grow on ISS are larger and better quality than crystals that can be grown on the ground: subsequent X-ray diffraction analysis yields a much better understanding of the protein structure. Again, know the structure, know the function - which in turn is the necessary step to develop new drugs to cure disease.

In the picture (Credit: ESA/Corvaja) you can see us working on the PCGF training model.

Italian translation of this logbook entry: L-265: Struttura e funzione: perché facciamo crescere i cristalli di proteine sulla ISS, by Paolo Amoroso—AstronautiNEWS.

L-263

Samantha Cristoforetti in JEM's SSIPC control room JAXA. Source: ESA / Corvaja

Houston (USA), 2014.03.06—Yesterday I flew from Tokyo to Houston - a very long Wednesday, 39 hours long. As I traveled East across the International Date Line, I "gained" a full day.

My time in Japan has been just lovely. Yes, ISS training is very standardized and in the end there is no big difference in learning about cooling loops of the JEM in Japan, of Columbus in Europe or of the US modules in Houston. But a training trip to Japan is also an almost overwhelming cultural experience. Unfortunately I don't speak any Japanese, so I can not even begin to scratch the surface of this rich culture. But even without understanding much, it's fascinating : it's impossible not to be touched by Japan's hospitality or enthralled by its sophisticated cuisine, with the variety of its ingredients and dishes and the elegance of service and presentation. You are bound to admire the strive to perfection, the attention to every minute detail in all things. And the kindness, politeness, readiness to help, which people meet you with are hard to match. A big thank you to our JAXA colleagues for making us feel so welcome. In the pictures you can see some of them during our visit at the JEM mission control room SSIPC (Space Station Integration and Promotion Center).

Now it's time to resume training here in Houston! After a free morning to rest from the flight, I'll have a training tagup and a photo/TV ops this afternoon.

Picture: ESA/Corvaja

Italian translation of this logbook entry: L-263: Un’esperienza straordinaria in Giappone. Grazie amici della JAXA!, by Paolo Amoroso—AstronautiNEWS.

L-261

Samantha Cristoforetti in a fire simulation in the ISS mockup at the JSC. Source: NASA

Houston (USA), 2014.03.08—Yesterday I had my first full day of training at Johnson Space Center on this trip.

First I had a workout on the ARED to practice "weightlifting" on this peculiar machine. ARED stands for Advanced Resistive Exercise Device - I talked about it here, if you missed it.

A typical ARED workout consists of six exercises and crewmembers on ISS rotate through different routines. Yesterday, for example, we did squat, deadlift, romenian deadlift, heel raise, shoulder press and bent over row.

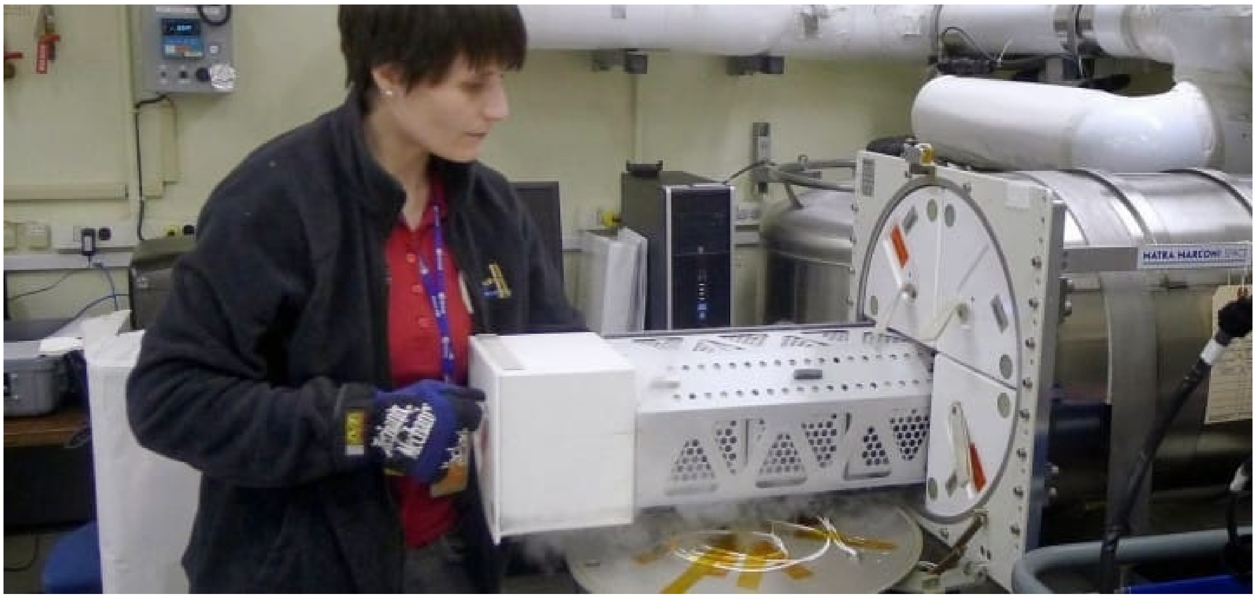
Later on the day I was introduced to Word Map software, which is loaded on many ISS laptops in support of Earth photography. Let's say you want to take a picture of a particular location on Earth, for example a volcano: either by picking it on the map or by geographic coordinates you can create a "target" in World Map. The software can then calculate pass predictions for you: when will that target come in your field of view? how long will be the pass? will it be day or night? at what angle will you see it? As you can imagine, this is invaluable information for Earth Observation ops!

Finally I had a review class on fire emergency response, in preparation of a simulation scheduled for the upcoming weeks for Terry, Anton and myself. The focus was a relatively new software applications that helps in locating a fire hidden inside a rack, in identifying equipment that should be turned off and, if necessary, what fire port we should insert the fire extinguisher in.

The picture was taken during a previous fire emergency sim last year. The tool is a measurement device for combustion product concentration. (Picture: NASA)

Italian translation of this logbook entry: L-261: Sollevamento pesi in stile ISS, fotografia della Terra e operazioni antincendio, by Paolo Amoroso—AstronautiNEWS.

L-259



Samantha Cristoforetti working on a Melfi training specimen at the JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2014.03.10—Many different things going on today for me at Johnson Space Center.

First thing in the morning a couple of hours of eye examinations: partly an annual requirement and partly related to the additional set of medical tests we have to undergo before a long-duration spaceflight. Not my favorite exam, because it requires inducing a dilation of the pupils with special eye drops. For a few hours afterwards the eyes are quite sensitive to light and it's hard to read.

Fortunately my vision was almost back to normal by the time I had a phlebotomy practice class: thanks to my countryman Luca, who works here at JSC and volunteered to have me draw his blood twice today!

I had to use my eyes and move them very quickly between camera views also in my last class, a refresher in flying the arm in support of a spacewalk. We flew part of the procedure that Koichi used on ISS last

December in support of the pump module replacement contingency EVAs. If you missed it, here you can read some words about robotic support for EVAs, in particular what we call GCA.

In between I also had a class on cold stowage operations. We have a lot of cold stowage needs on ISS, both for science as well as for medical exams, since we routinely take blood and urine samples that need to be conserved and then returned to Earth for analysis. In the picture you can see me practicing working with the Melfi - actually only one representative unit. The actual Melfi has several of those freezer units and we have three Melfi racks onboard. We use them to stow cold packs as well, which in turn we use when samples have to be returned to Earth to prevent breaking the cold chain.

Italian translation of this logbook entry: L-259: Pupille dilatate, la catena del freddo e prelievi di sangue, by Paolo Amoroso—AstronautiNEWS.

L-258

Samantha Cristoforetti in training in EMU suit at the JSC. Source: NASA

Johnson Space Center (Houston, USA), 2014.03.11—Today I got to try a flight space suit!

I went to the facility that produces the EMU spacewalking suit for a fit check in Class 1 hardware - components that are not meant for training in the pool, but rather for space. The purpose was to get the configuration of the suit that I would use on orbit, which can differ somewhat from the one in the NBL, since in the pool we don't actually float inside the suit itself. A lot of the padding that, being a small person, I use in the water to prevent me from shifting "down" inside the EMU whenever I change body orientation is not needed in weightlessness.

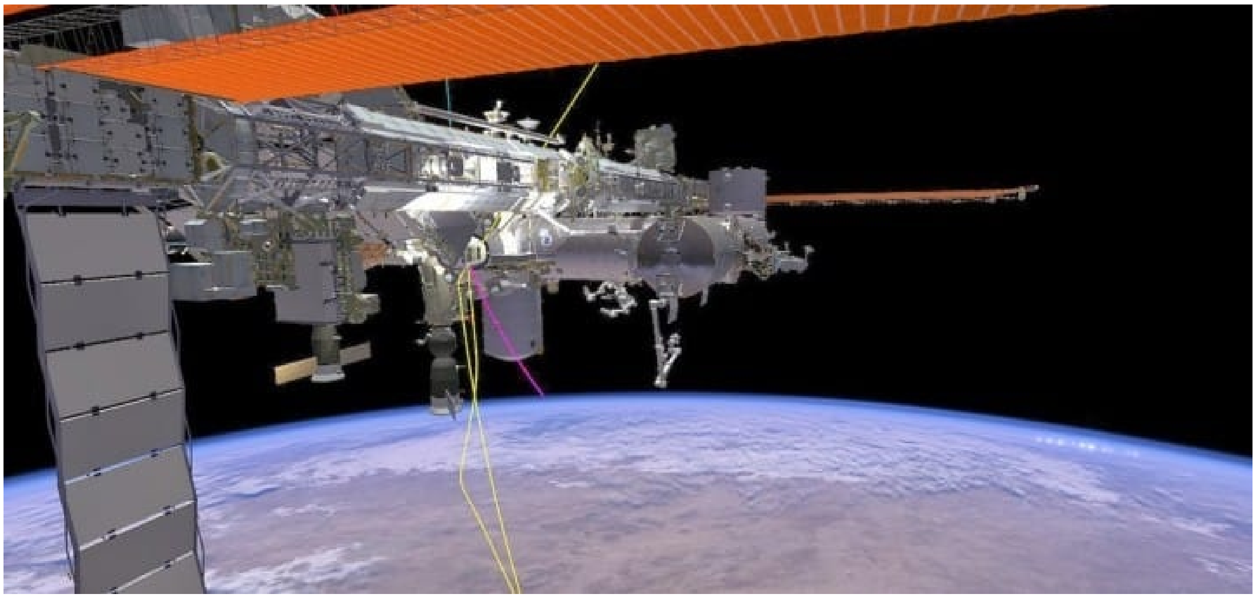
It was also a chance to work with Class 1 gloves inside the suit and evaluate the fit. As you might remember, I had [a separate glove fit check] in the glove box in the past.

Once the fit check was completed, we verified that I could reach all the switches, levers and controls on the the Display and Control Unit (DCM) in front of the suit, that I could attach the umbilicals and that I could raise and lower the visor, turn on and off lights and cameras and open the purge valve, which basically opens a hole in the helmet to vent oxygen outside - but no worries, the suit regulator is capable of compensating for that, so internal pressure in maintained. May not be so important when it's just overpressure with respect to ambient pressure, but certainly important in vacuum!

As you can see in the picture (from a past event) we often operate the controls with one hand, while we hold up the other hand to use the mirror that we have at the wrist.

Italian translation of this logbook entry: L-258: Ancora in tuta EMU, ma una piuttosto diversa, by Paolo Amoroso—AstronautiNEWS.

L-257



A screen of a SAFER training session at the JSC. Source: NASA

Johnson Space Center (Houston, USA), 2014.03.12—Another very varied day, split between training and medical exams.

First thing in the morning a short introductory lesson on performing the Cardio Ox experiment, a study on the cardiovascular effects of long-duration spaceflight and the correlation between changes in the heart and in the arteries with oxidative and inflammatory stress. While the latter is measured through biomarkers in blood and urine, heart and arteries are observed via ultrasound. Of course we're not expected to become proficient at performing ultrasound scans: we'll be remotely guided from the ground as we examine our own brachial and carotid arteries and our heart.

In another class I had a chance to work with Hi-Fidelity EVA hardware and some of the units that could potentially be replaced during a spacewalk, if they failed. From big battery "boxes" that store power from the solar arrays during insulation to the big tanks that contain ammonia for the external cooling loops to the tanks that contain the nitrogen to pressurize those same cooling loops to units that provide venting capability of that ammonia to space from the radiator lines in case of a malfunction… and that's just a tiny selection of the dozens of units out there that can be replaced on an EVA.

I also had a very sophisticated test of my vestibular system - basically a balance test, but one in which visual and proprioceptive cues are carefully controlled to isolate as much as possible the effect of the vestibular system itself on balance. I will repeat this test once more before flight and then again after returning to Earth: everybody's vestibular system is in pretty bad shape after a long-duration spaceflight.

Finally, I had a practice class on the SAFER, the jetpack unit attached to the back of the EMU suit that is intended to provide self-rescue capability to a crewmember who should come detached from Station. Just to be clear - it was never actually used (except for testing purposes). Other that George Cloney's jetpack in Gravity, the SAFER has only very little gas. That's why we train to fly back to structure in the most fuel-efficient manner possible in a virtual reality environment that replicates the ISS. In the picture you can see a picture of a virtual reality run: the yellow line is the trajectory flown away from Station and then, with the help of the SAFER, back to it.

Italian translation of this logbook entry: L-257: Test di equilibrio, volo con il jetpack e controllo del battito cardiaco, by Paolo Amoroso—AstronautiNEWS.

L-254

Samantha Cristoforetti performs a measure of muscle strength at the JSC. Source: Samantha Cristoforetti

Houston (USA), 2014.03.15—Medical requirements and payload training are popping up more and more frequently in my schedule. Payload training, by they way, that's how we call experiments training. Scientific research and technological development are the reason why ISS exists, hence that's our payload!

For example, on Thursday I've had a briefing on the experiment "Microbiome". Did you know that about 9 out of 10 cells on the human body are actually… not human? They belong to the microorganisms that live inside our body and on our skin and make up what we call the microbiome. Most of them are beneficial to us: they facilitate digestion, provide Vitamin K, enhance the immune function and more. How changes in the microbiome affect our health is actually a pretty hot topic right now in medical research. This ISS experiment will study how the microbiome is affected by long-duration spaceflight.

The "microbiome" protocol involves taking samples of urine, feces and saliva at certain intervals before, during and after the mission. Body swabs are also collected to investigate the microorganism population on the skin surface.

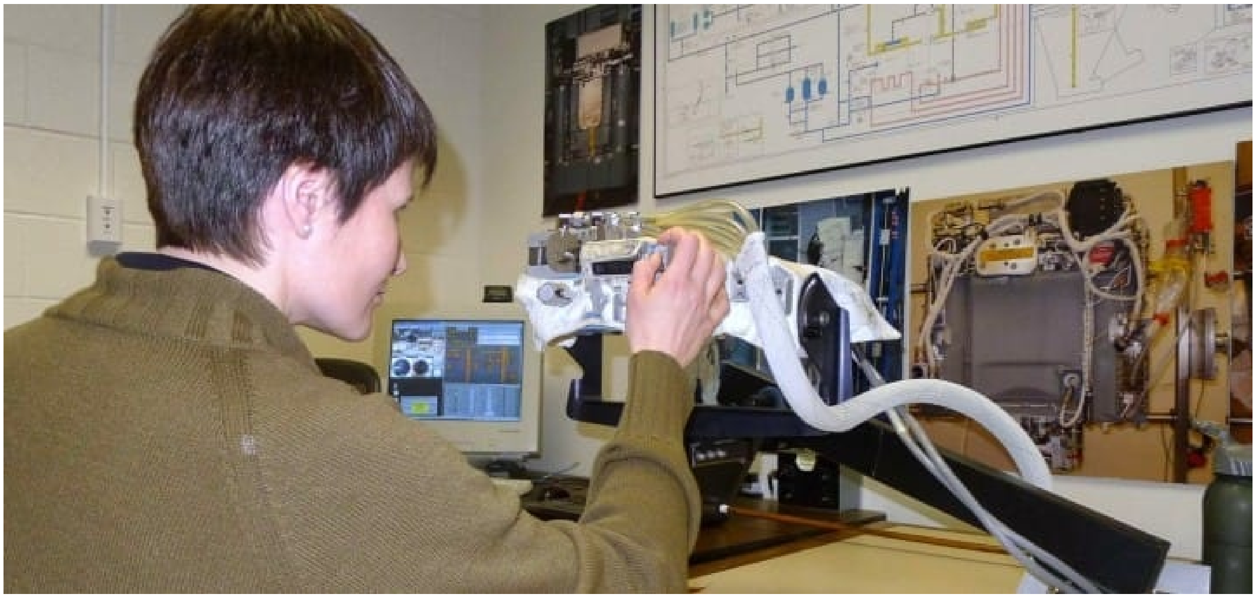
Sample collection is often shared between experiments. For example, this week I'm doing a saliva collection every morning not only for "Microbiome", but also for "Salivary Markers", which investigates immune system dysregulation during spaceflight.

Changes in muscle strength are instead the object of a medical requirement. We take measurement of maximum strength across several joints a few times before and after spaceflight to have quantitative data on the loss of strength and the recovery time. In the picture you can see the setup to measure strength across the knee.

Now to a interruption notice: looking at my training schedule in the next couple of weeks, it looks like I will be so busy that I won't be able to write the Logbook. But I'll be back soon! In the meantime, I'll try to post shorter updates on Twitter. If you are on Twitter, you'll find me as @AstroSamantha. Sorry for the unplanned Loss Of Signal. See you on the other side!

Italian translation of this logbook entry: L-254: Sapevate che il 90% delle cellule del nostro corpo non sono umane?, by Paolo Amoroso—AstronautiNEWS.

L-242



Samantha Cristoforetti examines the wiring diagrams of the EMU suit at the JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2014.03.27—I'm back! I'm really sorry for the interruption of the logbook, but these last couple of weeks have been really very busy here at Johnson Space Center - an intense schedule filled with many kinds of events: robotics, experiments, systems reviews, photo/TV ops, emergency simulations, leak scenarios, medical exams, baseline data collections for human physiology research I'll participate in.

In addition, a lot of EVA classes: familiarization with high-fidelity hardware, decompression sickness response, ammonia contamination response and some time under water. Terry and I had two suited runs at the Neutral Buoyancy Facility. In the first one we simulated replacing the end-effector of the robotic arm, in the second one we worked on the Flex Hose Rotary Coupler (FHRC), a unit that allows transfer of ammonia from the stationary truss to the rotating radiators. The FHRC is one of the most challenging units to replace during a spacewalk. In fact, the full replacement would likely take four EVAs. In the pool we only practiced

EVA number 3, the retrieval of the spare unit and its installation, which involves mating many challenging electrical and fluid connectors inside the truss. This was also our official EVA evaluation run and we both passed!

In the picture you can see a class I had today. It's part of series of events in which we review the schematics of the EMU suit and then we go through a number of malfunction scenarios. The instructor can input any failure in the simulator and we get the corresponding signatures on the display of the Display and Control Unit (DCM), which is attached on the chest area of the real suit. During a nominal EVA you would hardly have any need to touch the DCM while outside of the airlock, but that would change quickly if the suit had any kind of failure, hence these opportunities to really get familiar with the malfunction responses and all the displays and controls on the DCM.

Italian translation of this logbook entry: L-242: Affrontare le emergenze della tuta in una passeggiata spaziale, by Paolo Amoroso—AstronautiNEWS.

L-241

Samantha Cristoforetti is trained in the maintenance of the EMU suit at the JSC. Source: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2014.03.28—Last day of training here at Johnson Space Center, before I travel back home to Europe this afternoon.

In the morning I had an extensive EMU class in which I learned to perform several maintenance tasks and tests on the EVA suit.

In the picture I'm working on removing the Water Line Vent Tube Adapter, which interfaces on one side with the tubing in the PLSS (the life support "backpack") and on the other side with the LCVG (the Liquid Cooling and Ventilation Garment). It has three flexible tubes. One central tube is the return line of the ventilation loop, which brings the gas back to the PLSS for cooling and for removal of CO_2 and condensate. The two other tubes are the supply and return cooling lines: water from the PLSS is circulated in the little tubes in the LCVG to collect heat from the body and is then sent back to the PLSS to be cooled again.

The excess heat is rejected to space via a sublimator, which was the focus of my next task. Using demonstration videos, I learned to insert test strips in specific locations to put them in contact with certain surfaces of the sublimator and test for presence of water.

Other tests I learned to perform are the leak check of the ventilation loop and the measurement of the water flow rate in the cooling lines. All these tests allow the specialists on the ground to make sure the suits stay healthy, as we do more and more maintenance tasks on orbit.

Italian translation of this logbook entry: [L-241: Attività per assicurarsi che la tuta spaziale rimanga in buono stato](), by Paolo Amoroso—AstronautiNEWS.

L-239

Samantha Cristoforetti with a mask with a respirator in training at the JSC. Source: NASA

Cologne (Germany), 2014.03.30—One of the most important events in our training flow for the Space Station are emergency simulations, because they concern situations that potentially put the crew in immediate danger and require therefor precise response actions. Anton, Terry and myself had an emergency sim a couple of weeks ago (during my logbook interruption). It was our last three-person session before our two six-person sims next summer: one with the Soyuz 40S crew that we will join on ISS upon arrival and one with the Soyuz 42S that will join us four months into our increment.

An emergency sim typically spans 5 hours and includes a numbers of scenarios covering the three emergency types we're concerned about: a fire, a rapid depressurization (we're losing atmosphere into space) and an ammonia leak from the external cooling lines into the cabin (highly toxic!).

So, what equipment do we have onboard to deal with these situations?

We have Caution & Warning panels throughout Station: if the emergency tone goes off, a quick look at the panel lights will tell us which situation we're in. On those panels we can also manually trigger an alarm, if we notice an emergency condition before the ISS computers or the ground pick it up.

In each module we also have oxygen masks and fire extinguishers, while in specific locations in the Russian segment we have respirator masks and filter cartridges to allow us to survive and operate in a toxic atmosphere: pink cartridges for ammonia, red cartridges for fire.

We also have several CSA-CPs, portable instruments that measure the concentration of combustion products. They help us locate fires that are hidden behind racks and they tell us if we need to wear breathing protection to avoid intoxication. Similarly, we have portable instruments to measure ammonia concentration.

Our best friend in case of a rapid depressurization is the Russian portable manovacumeter, which measures atmospheric pressure. As we close hatches in sequence trying to isolate a leak, the needle of the manovacumeter will hopefully stop moving before we need to evacuate station, indicating that we have put a closed hatch between ourselves and a hole to space.

You can see some more pictures of an emergency sim last year here.

Also, if you want to read more about the fire response, here's an older blog entry about it.

Italian translation of this logbook entry: L-239: L'equipaggiamento d'emergenza sulla Stazione Spaziale, by Paolo Amoroso—AstronautiNEWS.

L-238

Samantha Cristoforetti trains in the Skin-B experiment at the EAC in Cologne. Credit: ESA / Grotheus

European Astronaut Centre (Cologne (Germany), 2014.03.31—After flying a "slow orbit" around the world for the last couple of months, I'm now back at the European Astronaut Centre in Cologne for some training on experiments and some medical exams.

Today I had an introduction to the portable Pulmonary Function System (PFS), an interesting piece of equipment that allows the analysis of gas exhaled by a subject. In some configurations the subjects breaths cabin air, in others he/she breaths a known gas mixture that includes a metabolically inert tracking gas. PFS is required for the new ESA experiment "Airway Monitoring", which should start during my increment on ISS. The protocol uses Nitric Oxide (exhaled or diffused into the blood) as a biomarker for inflammation of the airways and aims at observing the effect produced by microgravity and partial pressure: for the latter, in particular, two subjects will be isolated in the airlock and the pressure will be reduced to about 10 PSI. It's a very new field of study and one that promises great insight into the gas exchange processes in the lung and the effects of the space environment on the respiratory system.

I also had a lesson on the experiment Skin-B, which is focused instead on the aging process of the skin. Generally speaking the Space Station is a great place to learn about aging, because unfortunately many body systems, including the skin, undergo an accelerated aging in space. Skin-B will observe that with a quick protocol involving pictures and measurements of hydration level and water diffusion from inside the skin (which points to a deterioration of the skin's barrier function). Tomorrow the principal investigators will be here for a baseline data collection session: I guess I will learn the actual "age" of my skin - at least the portion on my forearm.

Picture: Skin-B training with Laura (Credit: ESA/Grotheus)

Italian translation of this logbook entry: L-238: Dopo “un’orbita lenta” di nuovo a Colonia per un po’ di scienza, by Paolo Amoroso—AstronautiNEWS.

L-237

An EVA astronaut next to the AIS antenna on Columbus. Credit: NASA

European Astronaut Centre (Cologne (Germany), 2014.04.01— Another science-intense day here at the European Astronaut Centre!

First a baseline data collection for the Skin-B experiments, that I wrote about yesterday: not only the relatively quick measurements I will do on orbit, but also some additional ground-only ones, including a layer-by-layer imaging of the skin in intervals of 5 microns.

Then I had a lesson on the ESA experiment Circadian Rythms - actually something that I was already familiar with from a previous baseline data collection. If you've been following this logbook for a while, you might remember it too.

Then a fitcheck for the very special shirt I will be wearing on ISS during several nights for the ASI experiment Wearable Monitoring. Via sensors embedded in the shirt, an electronic box will record the electrocardiogram and the cardiac mechanics of the heart, like the opening and closing of the different cardiac valves. The aim is to gain insight into the quality of sleep in microgravity, which for most astronauts is not as good as on the ground. And, as you can imagine, acquire knowledge that will help people with sleep disturbances on Earth.

Finally, an familiarization briefing with the Vessel ID System, which tracks from ISS the ships equipped with AIS (Automated Identification System). Vessel US is a technology demonstrator to assess the feasibility of a space-based tracking system for global maritime traffic. You can learn more about it here.

Picture: spacewalking astronaut next to the AIS antenna on Columbus.

Italian translation of this logbook entry: L-237: I ritmi circadiani, il sonno, e il monitoraggio del traffico marittimo, by Paolo Amoroso—AstronautiNEWS.

L-235

Thomas Reiter performs a Periodic Fitness Assessment on the CEVIS cycle ergometer of the ISS. Credit: NASA

European Astronaut Centre (Cologne (Germany), 2014.04.03— Yesterday I had a day of outreach activities, especially dedicated to media interviews. The best part was talking remotely to a few hundred kids at the final Mission X Italian event in Rome. In the past weeks they have learned to eat healthy and train like an astronaut. I hope they will keep up those good habits!

Today was a day of medical activities, including several exams required for my medical certification.

That included a treadmill stress test in which the speed is increased progressively to maximum exertion, while the cardiovascular function is monitored. During this test we also measure VO_2max, or the maximum oxygen uptake, a indicator of aerobic fitness. Here in Cologne we measure VO_2max on the treadmill. In Houston I have additional sessions to measure it on the bike, so that it directly correlates to what we measure on orbit during the monthly PFE sessions (Periodic Fitness Assessment).

In the picture you can see former ISS crewmember Thomas Reiter performing a PFE on the CEVIS cycloergometer. To measure oxygen uptake we use the portable Pulmonary Function System - I learned a few days ago how to set up all the connections and hoses.

Finally, today I also had a briefing with my flight surgeon, Brigitte. We covered a number of topics, including for example the Private Medical Conferences (PMC) between surgeon and crewmember. PMCs are scheduled for 15 min every weekend and are an opportunity to discuss any medical issue on a privatized channel. Or, if everything is good, they are a good time for a chat with a friend!

Italian translation of this logbook entry: L-235: I test sotto sforzo e le valutazioni periodiche della forma fisica, by Paolo Amoroso—AstronautiNEWS.

L-233

Samantha Cristoforetti in COL-CC with the Increment Operations Lead for Increment 42 (Simon, right) and Increment 43 (Caesar, left). Credit: Samantha Cristoforetti

Cologne (Germany), 2014.04.05—Yesterday I took a very early flight from Cologne to Munich for a one-day visit at the Columbus Control Centre, short: COL-CC.

COL-CC is responsible for planning and real-time ground control of all operations in the European laboratory Columbus on the International Space Station, both concerning the systems and the science (payloads).

I had a short brief by the increment leads of all the teams, who introduced their teams and provided an overview of the major activities foreseen during my time onboard, as well as any issues they are currently tracking. Of course, the picture is still a bit blurred and subject to change: we're still 7 months from Increment 42 and some activities depend on the not-yet-finalized launch manifest of the cargo vehicles, bringing for example the equipment for new science experiments.

Whatever the details will turn out to be, it's clear that there's a challenging year ahead for Columbus, with a lot of new, complex experiment hardware to be launched, assembled and commissioned by my fellow Shenanigan Alex, first, and then by myself. But the COL-CC team is committed to make it all happen and I certainly will do my best to do my part right!

One of the key figures behind a mission to ISS is the Mission Director, the person who knows everything and coordinates the efforts of all the teams to make sure that things go smoothly and on schedule. It's really a small world: my Mission Director Alex is an aerospace engineering graduate of the Technical University of Munich. Just like me, just one year apart!

Another key figure is the Increment Operations Lead, who is the lead flight director (COL-Flight) for the increment. In the picture you can see me with Simon (right) and Cesare in the Control Room. Simon will be responsible for the first part of my mision, Inc 42, and Cesare will take over for Inc 43.

There was also some time for little traditions, like putting a mission sticker at the entrance of the control room and signing it.

By the way, COL-CC also has a blog: especially exciting with the upcoming mission of my fellow shenanigan Alex!

Italian translation of this logbook entry: L-233: Una giornata con il team del Columbus Control Centre!, by Paolo Amoroso—AstronautiNEWS.

L-228

Samantha Cristoforetti in an exercise in Sokol suit in the vacuum chamber. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.04.10—A case of low pressure today!

I went to the facilities of the company Svesda (Звезда), which manufactures our Sokol pressure suits and our seat liners. As you might remember, my personal custom-made Sokol suit, sequential number 422, has been ready for a while. Last February I wore it for two hours with a 0,4 atm of overpressure to make sure it fit properly in an inflated state. If you missed it, that story is in L-280 Logbook.

Today I tested the nominal functions of my Sokol in the vacuum chamber, where I spent a couple of hours lying in a Soyuz-type seat and in my custom-fit seat liner. First we leak-checked the suit, just like we'll do on the launch pad before the start: I manually closed the blue regulator valve and verified that the nominal overpressure was reached within a specified time limit. Then I reopened the regulator and put it back to the nominal setting of 0,4: should the pressure around me drops below 0,4 atm (and obviously that's the plan of the day), the regulator maintains the internal pressure constant at that value.

After a successful leak check, the chamber door was closed and we started the exercise. First the pressure was lowered to 5 km. It might be confusing to use km as a unit when we're actually talking about pressure, but it's pretty typical in a hypobaric chamber. The pressure is referred to the standard Earth atmosphere: when we say that we are 5 km, we mean that the pressure in the chamber is equivalent to what you would have on Earth at 5 km altitude (which is about half of the pressure at sea level).

At 5 km we stopped momentarily, the ventilation was interrupted and the supply of pure oxygen was turned on instead. That's a much smaller flow - just like it would be in the Soyuz - and from this point on it started to get a bit warmer inside the suit, as we resumed our "climb" to higher altitudes and lower pressures. At 7km I felt the suit starting to inflate and the needle of the gauge showing the suit's overpressure starting to move from the zero position: the regulator had kicked in, preventing the internal pressure from dropping below 0,4 atm.

Eventually we arrived at 30 km, where the pressure is about 1/100 of the sea level value - for all practical purposes today: vacuum. At that point the suit, still at constant internal pressure, was quite inflated and very rigid. Would be quite a challenge to operate in this state, but hey… I'm certainly not complaining. On a really bad day, it might save my life - just like it protected me from vacuum today!

Photo: Yuri P. Kargapolov

Italian translation of this logbook entry: L-228: Oggi un caso di bassa pressione!, by Paolo Amoroso—AstronautiNEWS.

L-226

Samantha Cristoforetti with the crew of the Soyuz TMA-15M in the simulator in Star City. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.04.12—First of all, happy Cosmonautics Day! I can't imagine a more suitable place to be in today than here in Star City, where it all started. Well, I guess next year will be even better, as I will be on ISS!

But there's still a lot of training to be completed before that and the coming weeks promise to be an exciting time. This is for me the "back-up trip" to Russia: Reid, Alex and Maksim will launch on May 28th and Terry, Anton and I will be their shadows until then. Just like them we'll take the qualification exams, we'll participate in all the pre-launch ceremonies and traditions and we'll fly to Baikonour for a two-week quarantine time. And then we'll watch them blast off to space!

In the Soyuz simulator with Anton. Credit: Terry Virts

So this past week I've resumed my Soyuz "routine". I had several manual flying sims (rendez-vous & docking as well as descent), while yesterday Anton and I were back together in the Soyuz simulator.

First we practiced the transition from the nominal quick profile (launch-to-docking in six hours) to the two-day profile. If you have followed the last Soyuz launch, you know that this is a very real possibility: Soyuz 38S had a minor issue with one of the burns and they had to interrupt the nominal profile to eventually dock two days later.

In our sim, however, after the transition we also got a leak in the pressurization lines of the propellant tanks: basically we were loosing pressure in the helium tanks that pressurize our fuel and our oxidizer, so that they flow to the combustion chamber when the appropriate valves are opened. No pressure, no engine firing! So we had to immediately initiate an emergency descent, before the pressure became too low.

A nice refresher sim, as we wait for Terry to join us next time. I attach a picture of Anton and myself that Terry took a while back… with some artistic liberty.

Italian translation of this logbook entry: L-226: Di nuovo nel simulatore Sojuz! In vista di un periodo emozionante, by Paolo Amoroso—

AstronautiNEWS.

L-224

Expedition 38's Soyuz docked at the ISS. Credit: NASA

Star City (Moscow, Russia), 2014.04.14—When you prepare for a flight on the Soyuz, you first learn about all the on-board systems one by one: you spend a lot of time in the classroom learning the theory and occasionally you get some time in the simulator, specifically dedicated to the one system you're studying. Once you've passed the exams on all the systems, you graduate to the complex simulator sessions that I've written about multiple times and in which you integrate all your knowledge of the separate systems into the actual flight operations.

Today Anton and I exceptionally reverted back to a single-topic practical training session, learning about new procedures to be applied in case of a computer failure just after undocking.

See, our Soyuz will be docked to the MRM-1 module, just like one you see in this beautiful image by the Expedition 38 crew. Like the photo shows, in the standard ISS attitude the MRM-1 points nadir, towards Earth. Typically, when a vehicle undocks the Station it rotated 90° so that the docking port faces aft - that makes if easier from an orbital mechanics point of view, because the simple impulse given by the spring-loaded pushers in the aft direction is enough to guarantee that there will be no collision, even if the Soyuz was unable to perform the separation burns.

However, it would be really nice to be able to leave the Station in its nominal attitude: it takes fuel to rotate it and the mechanical loads can cause fatigue on the structure, which affects the Station's lifetime.

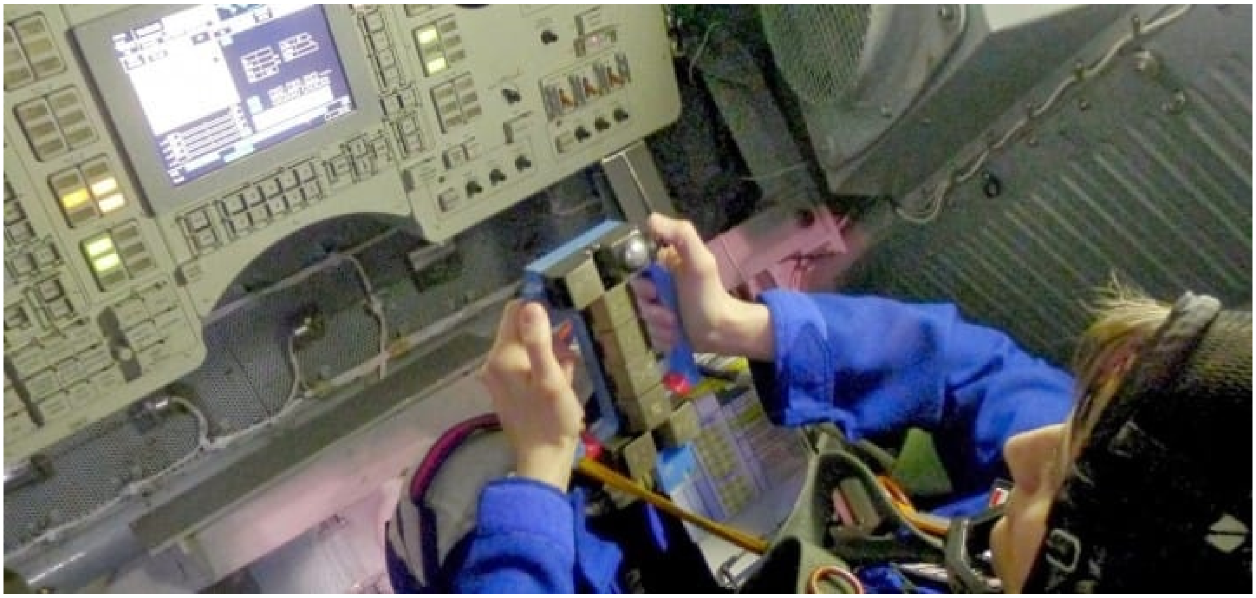
If the docking port is nadir, though, proper separation burns must be performed to ensure safety. That's why we now have new procedures in development that allow the crew to give the burns manually, should the computer fail before completing them.

Was fun to try something new!

Photo: ISS Expedition 38

Italian translation of this logbook entry: L-224: Per risparmiare propellente e allungare la vita della Stazione…, by Paolo Amoroso—AstronautiNEWS.

L-223



Samantha Cristoforetti trains for the Soyuz manual re-entry exam in the Star City centrifuge. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.04.15—Today I took a ride on the impressive 18-meter-arm Star City centrifuge.

As a preparation for the upcoming manual reentry exam, I had a dry-run today in which we went through a typical exam session: three reentry scenarios with the running centrifuge with two static scenarios to rest in between.

I've talked a little bit here about how manual reentry works.

The goal is to land within 10 km from the nominal touchdown point - the one that the computer-controlled reentry would fly us to, if it worked. But it's also important to keep the Gs under control. Especially if we're trying to compensate an overshoot in the time we made contact with the atmosphere (i.e. we made contact later than planned), the temptation is to give inputs that will lead to huge G-loads in an attempt to correct back. In an exam setting that will affect the score, but in real life, as well as in the centrifuge, it also affects one's level of discomfort and pain. Let's say it's a self-punishing mistake!

Under heavy G-loads it is quite difficult to move at all. Luckily, to fly the reentry we only need to press two buttons, the ones under my thumbs in the picture. Those inputs change the roll angle of the descent module in discrete increments of 15°, roll being the rotation around the axis of symmetry. It's not very intuitive, but the roll affects the lift, so that we can control how steep or shallow we want to fly. (For those we want to try to figure it out, here's a hint: the center of mass of the vehicle is displaced with respect to the axis of symmetry).

If you want to know more about riding the centrifuge, here's an older blog post about it.

Italian translation of this logbook entry: L-223: Prova generale d'esame nella centrifuga, by Paolo Amoroso—AstronautiNEWS.

L-222

La centrifuga di Star City. Credit: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2014.04.16—Anton and I both passed our manual reentry exam in the centrifuge today and are now officially qualified to fly the Soyuz reentry manually as backup crew of Expedition 40, launching in May.

In fact, this is the first of a series of qualification exams we'll have to pass between now and early May. So, first one done!

I did get one profile with a pretty high overshoot, in which I had to "fly the centrifuge" up to 5Gs. I had flown an 8G-run before, but it is indeed a bit different when you're trying to fly your trajectory and do your reporting to the ground.

Was fun! I'll do it again in a few months as prime crew.

Photo credit: Gagarin Cosmonaut Training Center

Italian translation of this logbook entry: L-222: Passato l'esame nella *centrifuga! Abilitata al rientro manuale della Sojuz, by Paolo Amoroso—AstronautiNEWS.*

L-220

Samantha Cristoforetti with her instructor Sasha in front of the approach simulator & manual docking in Star City. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.04.18—Last manual docking training sessions these days before the upcoming exam. With my instructor, Sasha, we've been focusing on the most tricky scenarios to make sure I'm ready. So, what makes a scenario more difficult than others?

The type of failure, for example: a "simple" Kurs malfuction, meaning that the Soyuz can't orient itself to Station any more, or rather a full computer failure? With a functioning computer we can turn on a function that compensates for the rotation of the ISS. When the Station is in its standard attitude with the stack of pressurized modules oriented along the velocity vector, it rotates about 4 degrees per minute as it tracks along the orbit. With the compensation function turned on, the computer automatically fires the thrusters to match that rotation, so that to us the ISS looks as though it was inertially stabilized.

If the computer fails, however, we need to constantly correct to keep the target aligned as we approach. The Service Module and MRM1 docking ports are especially tricky, because the targets are oriented in such a way that rotation occurs in two channels.

Night approaches are also a little bit more difficult. If we're about to enter eclipse, we station-keep at a distance of about 70 meters and turn on the Soyuz light. At that point we also have to remove a screen we have on our periscope view during illumination, that protects us from being blinded by excessive light. Once that screen is removed, more light comes through and we're able to see ISS with the rather faint illumination from our Soyuz light, but it's a bit more uncomfortable to fly the approach. For one thing, without the extra screen you need to have your eyes perfectly aligned at the right distance to see the image: if you move your head a bit, you immediately loose it. Also, as you come in closer for final approach and docking, the light does become somewhat dazing again.

So these are the scenarios Sasha and I have been focusing on. You can see us in the picture together before the sim today. Sasha wants to become a cosmonaut (she'd be a second generation). If you ask me, I'd bet my money that she will make it.

If you celebrate Easter this weekend, happy Easter!

Italian translation of this logbook entry: L-220: Affrontare scenari di attracco complicati con la mia istruttrice Sasha, by Paolo Amoroso—AstronautiNEWS.

L-216

Samantha Cristoforetti examines the body mass measurement device on the ISS in Star City. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.04.22—Yesterday Anton, Terry and I followed the prime crew, due to launch in May, to Mission Control Center - Moscow (MCC-M) for several hours of briefs concerning the content of their flight. As the backup crew, we need to have the same awareness, just in case.

Briefs covered everything, from the Sun angle expected at the time of docking to any abnormal behavior currently observed on the Russian segment of the Space Station. The latter is especially relevant for our Russian crewmates, of course, since it's mainly up to them to take care of the Russian modules. I had not been at MCC-M, or ЦУП, since a visit with the other Shenanigans during basic training in 2010. Time flies!

Talking about mission content, we'll have a theoretical exam next week, both about the Soyuz flight and the increment time on ISS. Today we had a preparatory session with our Soyuz instructor, in which we went over the different nominal and off-nominal profiles, as well as common crew actions.

We practiced answering questions like:

- in any given day, on what orbits is it possible to land in the nominal area in Kazakshan? (Answer: on the 16h, 1st, 2nd and 3rd).
- In what orientation are the burns after insertion given? (Answer: the first two simply "forward", the other two with a rotation calculated by the computer).
- What is the crew expected to report about at the beginning of the 20-min com pass during the second orbit after injection? (Answer: leak checks, first two burns, any anomalies, readiness to perform test of manual controls).

And so on, you get the idea.

I also had just now a short class on the body mass measurement system, the answer (or one of the answers) to the question: how do you weigh yourself in space? You can see the ground model of the system in the picture. In this video NASA astronaut Jeff Williams explains how it works:

Video: Mass Measurement (2:54)

Italian translation of this logbook entry: L-216: Tante domande! Fra cui come pesarsi nello spazio, by Paolo Amoroso—AstronautiNEWS.

L-215

Samantha Cristoforetti and Terry Virts are trained to use a camera in Star City. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.04.23—A day in the classroom today. Quite typical in the first year or so of the training flow, but pretty unusual these days, closer to flight. However, it does happen.

In the morning we spent 4 hours preparing for a routine ops sim in the Russian segment mockup on Friday. Anton is of course our resident expert on the Russian segment: he has specialist-level training on all the Russian modules. Terry and I only have user-level training, quite basic. We know how to use the toilet, get water, prepare food, use the communication panels; we know how to act in case of an emergency, we're familiar with lights, electrical outlets, safety equipment and we have basic familiarity with the Russian control laptops. We can do simple routine maintenance tasks, like changing filter or replacing a full urine container. Beyond that, it's really up to our Russian crewmates. Roles are reversed of course in the US, European and Japanese modules of the Station.

In our routine ops sim on Friday we'll have our day planned according to a Russian daily scheduling radiogram, called Form 24. I am scheduled to replace filters, simulate using the toilet, get water samples, rehydrate meal pouches, heat food cans, have a HAM radio contact, change the solid waste container in the toilet, photo- and videodocument some activities and unstow some Progress cargo, updating the Inventory Management System. Most likely we'll also have malfunctions and one emergency scenario thrown in.

In today's prep brief the room was full of people, all the specialists for the different systems. One after the other, they all briefed us on the tasks concerning their area of expertise. In the picture, Terry and I are getting a review of the camera.

More classroom in the afternoon: a brief for our Soyuz sim tomorrow and prep for our upcoming exam on the content of Exp. 40/41, of which we are of course the backups.

Italian translation of this logbook entry: L-215: Prepararsi a simulare una tipica giornata nel segmento russo, by Paolo Amoroso—AstronautiNEWS.

L-214

The instructor follows a fire simulation in the Soyuz with Samantha Cristoforetti and the crew of the Soyuz TMA-15M. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.04.24—Maybe you remember that last December Anton and I went to Energia to do the acceptance verification of the Soyuz that will bring Max, Reid and my fellow Shenanigan Alex to space end of May. As I wrote back then, it's quite a rare treat for non Russians to be able to go. Well, it happened again!

Anton, Terry and myself we got to go as a crew this morning to the acceptance verification of our own Soyuz! Now that hasn't happened in years, we've been told. I'll let you read about the acceptance verification in the L-358 Logbook.

But let me tell you, even if the task was the same, it was a very different feeling to be inside our own spaceship. How you can instantly be in love with a collection of metal, hoses and cables! She's just a beauty.

In the afternoon, we had a fire sim with Terry and Anton in preparation for the upcoming Soyuz exam. A fire scenario is one of the most rushed and complex, so we thought it was a good idea to practice it again. You can read more about fire on the Soyuz in this previous logbook.

We also got all kinds of small and big malfunction making our life hard, but hey… we can take it by now. As a crew we're as prepared as we'll be!

Photo: our instructor Dima at the control panel as our descent module simulator starts filling with smoke.

Italian translation of this logbook entry: L-214: Prima una visita alla nostra Sojuz (è una bellezza!), poi un incendio (simulato), by Paolo Amoroso—AstronautiNEWS.

L-211

Samantha Cristoforetti replaces the urine and solid toilet waste container in the mockup of the Russian segment of the ISS. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.04.27—Study day here in Star City. We planned a study session this afternoon with the prime crew to prepare for Tuesday's theoretical exam on the flight program, in which we will be tested about our system knowledge and asked all kinds of questions about the nominal flight profile and all possible off-nominal "branches".

Looking back at last week, on Friday Anton, Terry and I had our routine ops sim in the mockup of the Russian segment, a full dress rehearsal for our upcoming exam.

Like I mentioned in the L-215 Logbook, as non Russian crewmembers Terry and I are not trained for complex tasks in the Russian modules, but we still had a busy day taking care of all kinds of routine activities. Before lunch I had already worked with hatches, the HAM radio system, the life support displays on the Russian laptop, the water distribution system, the photo and video equipment, the ventilation system and the com panels for a routine check with Anton. Of course I had also demonstrated my skills in changing the urine and solid waste container of the toilet. And coming close to lunch time Terry and I prepared some space food: we heated some cans in the food warmer and we rehydrated juice pouches.

Some more routine tasks in the afternoon, including taking water samples from the dispenser for analysis in the Total Organic Carbon Analyzer we have on ISS. And of course, at some point we had a an emergency scenario. A simulated Mission Control Houston called us to ask for a pressure verification, since they were showing an ongoing drop in their telemetry. And sure enough, also on our manual gauge (actually radio controlled by the instructors), the pressure was dropping. And so we pressed the emergency alarm, to initiate the vehicle's auto-response, and off we were into the depressurization procedures.

A few more pictures here.

Italian translation of this logbook entry: L-211: Addestramento alle attività di routine nel mockup del segmento russo, by Paolo Amoroso—AstronautiNEWS.

L-210

Samantha Cristoforetti in a Soyuz manual docking simulation. Source: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2014.04.28—Passed my manual docking exam today! Now I am officially qualified to dock the Soyuz to the Space Station. I doubt I will ever have to do that, because the Commander is prime for this task, while the flight engineer is a just-in-case backup. But it doesn't matter: I'm one of those people who enjoys immensely simply getting to the point of mastering something!

First Anton and I took our regular places and Anton flew his exam profiles. Then we swapped places, I sat in the Commander seat with the hand controllers in front of me and flew my own four profiles.Each profile docks to a different docking port. You can check L-357 Logbook for an overview of the ports.

On the exam day, we always start with the simplest task, as a warm up: moving the Soyuz from one docking port to another. After the hooks open and the pushers give us a separation speed, we move out to a distance of 40-60m, fly around to the other port and dock again.

The next profiles are in random order.

In two of them we are around 300 m from ISS and we're not aligned to the docking port. We fly in to a safe distance of about 200 meters, hold that distance and perform a fly-around to align ourselves with the docking port. Then we fly in to a a distance of 50-100 meters and hold position again: we roll if necessary to align the target in our view, we retract one antenna that, if extended, would impede docking, we make sure that the docking system is ready and then we receive permission from MCC-Moscow (or the instructor) to go for docking. Most people, including me, hold position again at around 2 meters to make sure that we have a perfect alignment and to be able to give a known impulse starting from zero velocity, so that we can dock within the allowed range of 6-15cm/sec.

(There was a more extensive discussion of the velocity issue here.)

Finally, we get a scenario in which we are already aligned to the docking port. In this situation, the auto-escape is enabled on the vehicle: if the computer fails, there is no way to override it, so there will be an automatic braking burn on two sets of thrusters for 30 seconds. Once that's complete, our job is to take over manually, stop the separation motion and move in again. Typically quite quickly, because this scenario has eclipse coming up within a few minutes and it's hard to see the Station from far away at night, even with the light turned on.

That's it flying the Soyuz manually until next summer. I'll miss it!

Italian translation of this logbook entry: L-210: Passato l'esame di docking manuale Sojuz!, by Paolo Amoroso—AstronautiNEWS.

L-207

Samantha Cristoforetti uses a laser rangefinder in the Soyuz orbital simulator. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.05.01—Terry, Anton and myself put a couple more exams behind us in the last couple of days.

On Tuesday we passed our theory exams on the flight program - both Soyuz and Russian segment. Especially the Soyuz one was very interesting, because these are alway occasions to learn some little details from the people who control the flight from Mission Control Moscow.

Yesterday we had our exam on manual rendezvous - that's where Anton needs to show his skills in flying a manual approach from about 2-3 km away from ISS to a station-keeping position at 50-100 meters from the docking port, while I go into the orbital module and use a laser range finder through a forward facing window to give him distance and velocity measurements.

This situation is contemplated in our two-day launch-to-docking profile, not in the currently nominal 6-hour profile. That's because in the shorter profile there is no time before the start of the rendezvous burns to set up the laser range finder in the orbital module. If a failure were to occur when we're still a few km away from Station, we would interrupt the approach and figure out the problem with the ground.

In the two-day profile, however, after the first two orbit-rising maneuvers we get a break, transfer to the orbital module and have time to set up the laser range finder, so that it is ready two days later when we actually fly our approach to ISS.

Today is a big holiday here in Russia, like in many places in the world. If you celebrate it, Happy 1st of May to you. Here in Star City we are off until Monday, but with the big full-day Soyuz exam coming up next Tuesday, there will certainly be a lot of studying going on!

Italian translation of this logbook entry: L-207: Altri esami Sojuz passati dal nostro equipaggio!, by Paolo Amoroso—AstronautiNEWS.

L-204

Samantha Cristoforetti and Alessandro Paleri of WeFly! Team. Credit: WeFly! Team

Star City (Moscow, Russia), 2014.05.04—Taking a break from my preparation work for next week's big exam, I'd like to share with you something that I'm really excited about: the partnership between my mission to ISS, Futura, and WeFly! Team.

Marco Cherubini of WeFly! Team with his plane. Credit: WeFly! Team

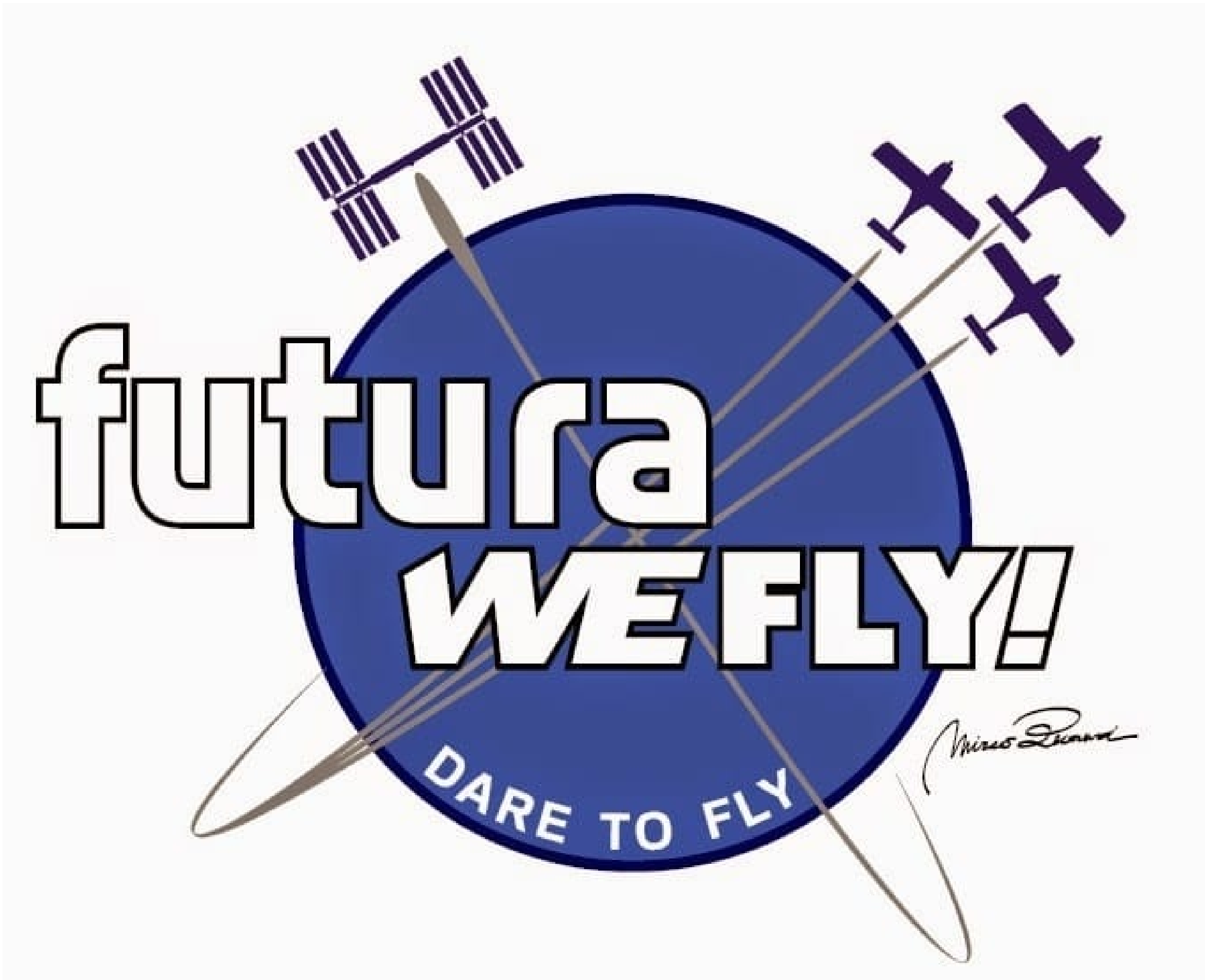
WeFly! is a very special aerobatic team, flying on ultralight machines: two out of the three pilots have a disability, which requires them to use a wheelchair during daily life and, in the cockpit, to use specially modified commands that allow full control of the aircraft by use of hands only.

I had the privilege of meeting Alessandro, Marco and Erich about 7 years ago. In this short video I tell that story:

Video: Samantha Cristoforetti and WeFly Team together for the disabled people (2:30)

WeFly with Futura: Dare to Fly!

The WeFly pilots! Team: Marco Cherubini, Alessandro Paleri and Erich Kustatscher. Credit: Marco Tricarico, WeFly! Team



The logo of the partnership between the Furura and WeFly mission! Team. Credit: WeFly! Team

The WeFly! Team in flight. Credit: WeFly! Team

An ultra-light WeFly aircraft! Team. Credit: WeFly! Team

Italian translation of this logbook entry: [L-204: Amici straordinari! WeFly con Futura, osa volare](), by Paolo Amoroso—AstronautiNEWS.

L-199

The Soyuz TMA-15M crew prepares for the Soyuz final exam as a backup for the Soyuz TMA-13M: Terry Virts, Anton Shkaplerov and Samantha Cristoforetti. Credit: NASA

Star City (Moscow, Russia), 2014.05.09—Incredible week behind me!

Together with Anton and Terry I have passed my final qualification exams both in the Soyuz and the Russian segment of the International Space Station and yesterday I have been part of a series of traditional events that mark the road to the launchpad. It's been an emotional roller coaster!

But let's catch up one thing at a time.

On Tuesday the prime crew had their full day exam on the Russian segment and we, as the backup crew, faced our Soyuz exam. We showed up early to get into our Sokol suits and at 8:20 we stepped in front of the commission. After reporting that we were ready to take our exam, our Commander Anton picked one of five sealed envelopes containing a list of five failures that would be injected in our profile during the day. Of course, we were not shown the content of the envelope.

To be honest, in our usual training sessions we practice dealing with a lot more malfunctions than just five. But it's also true that there's a lot of mistakes that can be made even on a nominal profile and we had many eyes checking our every move!

In the morning we flew a profile from start to docking, which went pretty smooth until a double failure at 40 meters from the docking port forced us to inhibit the autoescape maneuver that the computer was about to initiate and to take over manually. Shortly thereafter we also had a failure of a docking sensor that led to onboard logic to initiate a retrograde burn: again, we had to override the automatic sequence and take over manually to complete the docking.

The biggest challenge, however, came in the afternoon. Turns out we picked the envelope with the most complex scenario: a fire just after undocking. Anton and I had to work parallel procedure for several critical minutes, with me dealing with the fire and him setting up the system for a braking burn for an emergency descent. After I "depressurized" the descent module to put out the fire, we rejoined on the same procedure to get ready for the burn and… the main computer failed, forcing us to quickly set up for a manual activation of the engine in what we call the analogue loop.

After a successful burn, separation, atmospheric reentry and parachute deployment, the exam was declared concluded. No significant mistakes were made and we ended the day with a perfect score! A great feeling, indeed, for all of us.

Italian translation of this logbook entry: L-199: Ricordare una settimana incredibile iniziata con l'esame Sojuz, by Paolo Amoroso—AstronautiNEWS.

L-197

The final backup test in the Russian segment of the ISS for the Soyuz TMA-15M crew: Terry Virts, Anton Shkaplerov and Samantha Cristoforetti. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.05.11—In the last logbook I've told you about last week Soyuz final exam. The following day, on Wednesday, we swapped placed with the prime crew: they flew the Soyuz and we spent 8 hours working in the mockups of the Russian segment.

Let's face it, this exam is especially important for Anton: all the complex tasks were assigned to him because, as a cosmonaut, on orbit he will mostly work on the Russian segment, while Terry and myself will mostly operate in the US/European/Japanese modules. But we tried to make our instructors proud by performing our relatively simple tasks flawlessly. Also, Wednesday was the "Day of the radio" in Russia, a day to recognize and celebrate all specialists working in the field of radio communication. On such a day, no mistakes were allowed in the use of the com system! And to be honest, the com system on the Russian segment can be somewhat confusing.

Just like on the Soyuz exam, at the beginning of the day we reported to the commission to pick our envelope with the failures we would be confronted with during the day. Again, as a specialist for the Russian segment Anton had to deal with all the malfunction, except the big emergency scenario that concludes the exam.

In our case, we got a depressurization scenario: at some point we got a call from a simulated Houston CapCom telling us that they were seeing a drop in pressure. We checked our portable pressure gauges, confirmed the drop, pressed the depress emergency button to iniated the vehicle's autoresponse, reconfigured the com system to have Houston and Moscow on all channels and off we were to our Soyuz, to make sure that our ride home itself wasn't the source of the leak.

Retreating to the Soyuz for a few minutes also gives the air flow sensors a chance to work. They are placed at the hatches between modules and, in case of a rapid pressure drop, they should be able to determine the module that is leaking. Sure enough, we had picked a relatively simple exam scenario: when we came back to check the Russian command laptops in the Service Module, they did show a positive resolution of the air flow sensors. Our leaking module was found! A series of isolation procedures later, we were officially done with the last of our exams.

After our debrief, it was time to celebrate! Together with the community of instructors and people who support us in the most diverse capacities, we joined the prime crew for many hours of partying at the rhythm of traditional Russian toasts!

Italian translation of this logbook entry: L-197: Il giorno che abbiamo passato il nostro ultimo esame da backup!, by Paolo Amoroso—AstronautiNEWS.

L-196

The Soyuz TMA-13M backup crew signs the visitor register in Gagarin's office at the Star City museum. Credit: NASA

Star City (Moscow, Russia), 2014.05.12—Following our exams last week and the joyful celebrations of Wednesday night, on Thursday Terry, Anton and myself joined the prime crew in a day of formal events and traditions.

It all started in the morning with a meeting of the interdepartmental commission responsible to evaluate our training. All our exam results were presented to the representatives of Roscosmos and several other Russian agencies, as well as ESA and NASA, and we were formally declared ready for the next step: quarantine and final training events in Baikonour.

Next was a short coffee break in which the doctor responsible for our quarantine made very clear to us - I guess especially to the prime crew - that the only way we can prevent ourselves from flying at this point is by getting sick or having an accident. And we were given a number of recommendations to avoid both, ranging from not shaking hands to avoiding crowded places.

After the press conference, we headed to the Star City museum for a traditional event: the signature of the guest book in Yuri Gagarin's office. Of course Yuri didn't have his office at the museum, but shortly after his premature death the office was reconstructed there will all the original furniture, objects and decorations. According to the tradition, before departing for Baikonour prime and backup crews take turns sitting down at the table and writing a few words in the guest book. It's a moving moment!

Traditions continued in the afternoon…

Italian translation of this logbook entry: L-196: Eventi formali e tradizioni prima di Bajkonur, by Paolo Amoroso—AstronautiNEWS.

L-194

The Soyuz TMA-13M backup crew on Red Square after paying tribute to the pioneers of space: Samantha Cristoforetti, Anton Shkaplerov and Terry Virts. Credit: NASA

Star City (Moscow, Russia), 2014.05.14—Rest week is over, it's time to pack for Kazakhstan already!

Two planes of the Gagarin Cosmonaut Training Center will be ready tomorrow morning to fly us from the nearby Chkalovskyi Airport to Baikonour. Yes, two planes: starting tomorrow, prime and backup crew are not allowed to be on the same vehicle. Terry, Anton and myself will be trailing behind the prime crew at about 15 minutes distance.

But before starting this whole new phase, let me wrap up my account of last week's traditional events. On the last logbook I told you about the day-after-the-exams morning. In the afternoon, we all boarded a bus headed for the Red Square for more traditions.

It was a splendid day. On the one side, it was a lovely spring afternoon with pleasant temperatures and blossoming nature. On the other hand, we pretty much had the entire Red Square to ourselves. Not that we are that important, but we did happen to be there at the right time. It was the 8th of May, the day before Victory Day, a major Russian holiday commemorating the end of World War II and honoring veterans and casualties. Since the Red Square was being prepared for the celebrations and the military parade of the next day, it was closed to the public.

Yuri Gagarin and many other famous cosmonauts are buried at the Cremlin, along with major engineers contributing to the space program, including of course Sergei Korolev. Crews heading to space, together with their backups, always come here to pay tribute to these giants of space exploration. In particular, we had a chance to lay some flowers on the grave of Yuri Gagarin at the Cremlin wall.

The official part of the visit being over, we took some time to enjoy the Red Square and we even had a quick tour of the Cremlin gardens beyond the wall.

I enjoyed the visit immensely, everything was just perfect. An ideal send-off for my fellow Shenanigan Alexander Gerst and his crewmates Max and Reid launching in… wow… exactly two weeks now!

Italian translation of this logbook entry: L-194: Pronti per Bajkonur dopo l'omaggio ai pionieri dello spazio, by Paolo Amoroso—AstronautiNEWS.

L-189

The Soyuz TMA-13M backup crew in front of the Baikonur monument. Credit: Samantha Cristoforetti

Baikonur (Kazakistan), 2014.05.19—Wow, it's been only four days since we've arrived in Baikonour, but it feels more like weeks. A short three-hour flight from Moscow and here we are, in such a unique world of spaceships and rockets and traditions, where everything else seems so far away.

We left Star City last Thursday in the morning, after a few traditional events that always mark crews' departures. The community - other astronauts and cosmonauts, representatives of the different space agencies, instructors and many more - gathers around a breakfast table; except that typically nobody eats anything. Instead, several toasts are spoken, mostly around the theme of well wishes for the prime crew and reminders to the backup crew not to relax. Before leaving, we all find some horizontal surface to sit down for a minute or so: not doing so would bring bad luck!

Once outside, Terry, Anton and myself walked behind the prime crew and their families to go and pose for some pictures, after which the prime crew answered some questions for the media. And then, before we knew it, we were on a bus to the Chkalovsky airport, where two Tupolev Tu-134 of the Cosmonaut Training Center were waiting for us.

Don't think we came to Baikonour alone. The so-called Operational Group flew with us, split in the two airplanes: instructors, drivers, doctors, sports trainers, suit specialists…. all the knowledge and expertise from Star City that we need for the two weeks of quarantine, the fit checks and all the way to launch. Most of these people have been here many times and it's apparent that they form a close-knit, efficient team. It was also clear right from the plane ride that it would be great fun sharing this experience with them!

I've heard and read so much about Baikonour, that finally arriving here was a very intense moment. But things went fast: we stepped out of the airplane and reported to the Energia representatives, who were waiting for us on the apron (Energia is the company that builds the Soyuz). Then, after enjoying the warm welcome of local school children, we jumped on a bus, incidentally the same bus that we'll drive to the launch pad on. With the prime crew riding in another bus in front of us, we left for our quarantine location. But as we passed by the famous monument representing Baikonour, we just had to jump out and take a picture!

More pictures here.

Italian translation of this logbook entry: L-189: Partire da un luogo leggendario per un altro, by Paolo Amoroso—AstronautiNEWS.

L-188

The backup crew in front of the Soyuz TMA-13M in Baikonur: Terry Virts, Anton Shkaplerov, Samantha Cristoforetti. Credit: Victor Zelentsov

Baikonur (Kazakistan), 2014.05.20—Last Friday, on the day after our arrival in Baikonour, we left early in the morning for the cosmodrome, where the Soyuz TMA-13M is being prepared for launch on May 28th. In fact, this so-called "first fit check" drives the entire schedule of the crews in the weeks before: they have to be in Baikonour in time for this event.

Anton and I already had a chance to sit in the spaceship of Max, Reid and Alex back in Moscow a few months ago, when we did the acceptance verification. (See L-358 Logbook).

But this time it was a very different feeling: this assembly of metal and electronics will bring our friends to space in less than two weeks, their lives will depend on it functioning properly. With that in mind, even more than if it were our own spacecraft, the one thing we kept telling ourselves was: "Don't break anything!"

We went inside one first time in our blue flight suits for a general familiarization and to go over a checklist to verify the overall configuration. Then we went inside a second time in our Sokol suits, and this time we really focused on moving carefully and deliberately to avoid any incident. It's a very cramped space and entering from above from the orbital module is obviously a lot more cumbersome than using the "fake" side hatch we have in the Star City simulators.

Both we and the prime crew went through a verification procedure of the communication system. In addition, the prime crew fully strapped in, since their seat liners were in place, and had a chance to experience the extension of the seats. When they'll come back to Earth in six months, their seats will extend before landing to arm the shock absorbers, which would damped the impact force in case of a failure of the retrorockets.

Picture credit: Victor Zelentsov

More pics here.

Italian translation of this logbook entry: L-188: Prima prova di adattamento nella Sojuz con Terry e Anton, by Paolo Amoroso—AstronautiNEWS.

L-187

The Soyuz TMA-13M backup crew in front of the Baikonur Gagarin monument: Samantha Cristoforetti, Anton Shkaplerov and Terry Virts. Credit: Gagarin Cosmonaut Training Center

Baikonur (Kazakistan), 2014.05.21—The raising of the flags in our quarantine location took place on Saturday morning: Anton and Terry could join Max and Reid in raising their country's flag, while I raised Kazakhstan's flag this time.

Afterwards, Terry, Anton and I exercised our backup crew prerogative of breaking quarantine for one day and we went on the traditional visit of the Baikonour monuments, leaving the prime crew behind.

After a brief stop at the Soyuz monument, we paid a visit to the statue of Yuri Gagarin, where we were warmly welcomed by the local school children and by the mayor of Baikonour. Terry and I were presented with a gift symbolizing the city (Anton received it already in the past) and then we all we laid some flowers at the statue, honoring the first human to fly to space. As we turned around, we posed for a traditional fun picture, matching Yuri's pose with raised arms.

The next monument we stopped at is dedicated to Chief Engineer Korolyov, recognized as the main contributor to the achievements of the Soviet space program in the 50s and 60s. Here, again, we laid flowers in recognition of his engineering genius and leadership.

Next stop: the Baikonour museum…

Picture credit: GCTC

More pictures here.

Italian translation of this logbook entry: L-187: Una prerogativa dell'equipaggio di backup: visitare la città di Bajkonur!, by Paolo Amoroso —AstronautiNEWS.

L-186

The backup crew of the Soyuz TMA-13M in Kazakh costume in a yurt replica at the Baikonur museum. Credit: NASA/Victor Zelentsov

Baikonur (Kazakistan), 2014.05.22—After visiting Baikonour's monuments to space pioneers, last Saturday Terry, Anton and I were taken on a very interesting guided tour of the Baikonour museum.

The history of Soviet and then Russian human spaceflight and the history of Baikonour are so tightly intertwined that you could say the museum is about both.

The cosmodrome and the attached settlements were built in the 1950s. There was nothing here before then, except for the train junction Tyuratam - this is the name of the railway station to this day. The name Baikonour actually belonged to a different city in Kazakhstan and was chosen to deceive foreign intelligence trying to locate the launch site. At the museum we've even been told that a mockup site was built in the real Baikonour that would look like a launch site if photographed from above by reconnaissance assets!

The museum has a rich collection of photographs and memorabilia and reaches well beyond Baikonour to cover international space exploration programs. In preparation of our visit, they also exhibited a small collection of photos from our training. That was a bit of a strange feeling, actually, to see yourself in a museum.

At the end of the tour we were shown a replica of Kazakh yurt and posed for a photograph wearing traditional clothes, before signing the museum's guest book.

Picture credit: NASA/Victor Zelentsov

More photos here.

Italian translation of this logbook entry: L-186: Esplorando il museo di Bajkonur, by Paolo Amoroso—AstronautiNEWS.

L-185

The crew of the Soyuz TMA-13M plants the traditional tree in Baikonur. Credit: NASA/Victor Zelentsov

Baikonur (Kazakistan), 2014.05.23—A week into our quarantine in Baikonour and six days to launch, things are picking up speed here, as more and more specialists are showing up to join in the effort. While all our lessons so far have been with our own instructors from Star City, today we met some new faces.

For example, today we had a meeting with representatives of the Search and Rescue (SAR) team. They just worked a Soyuz landing last week and now are turning their attention to their upcoming launch. Of course, if all goes well there's not need for the them to intervene on a launch day, but believe me: they're ready.

When Alex, Reid and Max will launch next week, SAR assets will be deployed along the ground path of their ascent to orbit all the way to the ocean, including a ship standing by in the Sea of Japan. Should a rocket failure occur at any time, the appropriate unit will be alerted and SAR assets will be immediately deployed to the expected landing location based on the time of the failure. More precise information on the expected impact site will be obtained as soon as the parachute opens and a positioning system is activated.

After nominal insertion into orbit, the SAR teams don't completely stand down, but some units remain in alert until the Soyuz is docked to ISS - which could be full two days later, if there is a transition to the two-day rendezvous profile. Should the crew need to perform an emergency reentry for any reason, the guardian angels will be ready to meet them.

Talking about things getting real, Reid and Alex now have their tree along the ones of every cosmonaut and astronaut ever departing to space from Baikonour!

Photo: NASA/Victor Zelentsov

Italian translation of this logbook entry: L-185: Incontrare i nostri angeli della Ricerca e Soccorso e piantare alberi, by Paolo Amoroso—AstronautiNEWS.

L-175

Samantha Cristoforetti trains on the ATV at the EAC in Cologne. Credit: ESA

European Astronaut Centre (Cologne (Germany), 2014.06.02—Four nights ago I watched my friends of Expedition 40/41 climb onto their rocket and, a few hours later, become an ever smaller light dot in the night sky of Baikonur. After following their successful docking to ISS, I've flown back to Moscow and then home to Europe. It's been four days since I've left Kazakhstan, but the images have kept coming back, as though a part of me was still lingering there. Maybe because we're now prime crew and that's where our path will bring us again in six months time. Maybe because it's like living a different life for two weeks and you don't want to let it go. Maybe because coming back means facing the hard truth that we have six months of intense training ahead of us, before we can climb on that rocket ourselves.

Scheduling wisdom calls for two weeks of vacation after the backup flow and before jumping into prime flow, however scheduling constraints called for an exception in my case, so here I am at the European Astronaut Centre for a week of payload and ATV training.

Right in the morning I've been reunited with Sasha for some refresher training in ATV rendezvous and docking. After a short review of the possible malfunctions by our instructor Oleg, we tried our skills in the sim and quickly reestablished our good crew coordination. After all, it's not been that long since our exam. (See L-291 Logbook).

In the afternoon I got a class in the assembly of the Plasma Kristall 4 experiment, due to arrive on Station in the fall. PK-4, to be installed in Columbus, is a joint ESA/Russian experiment studying the properties of complex plasma in microgravity, with actual experiment runs will starting next year.

Italian translation of this logbook entry: L-175: Affrontare la realtà: altri sei mesi di addestramento prima del nostro turno!, by Paolo Amoroso—AstronautiNEWS.

L-174

ATV-1 Jules Verne. Credit: NASA

European Astronaut Centre (Cologne (Germany), 2014.06.03—Some more ATV training today at the European Astronaut Center for Sasha and myself.

This time we focused on the departure monitoring, meaning the procedures crewmembers work through with the ground on departure day to make sure ATV undocks from Station and performs a proper departure burn to put some safe distance between itself and the ISS. The next ATV is scheduled to launch and dock this summer and will still be docked to the service module in November, when I'll arrive to Station.

When Sasha and I will do the departure monitoring for real on orbit, it will be quite an emotional moment for us and for the European space community: the departure of ATV5 Georges Lemaître will mark the end of the Automated Transfer Vehicle program, which included the successful missions of ATV1 Jules Verne, ATV2 Johannes Kepler, ATV3 Edoardo Amaldi and ATV4 Albert Einstein and has demonstrated robust operations and extremely precise automated docking technology. It will be with mixed feelings that we will watch it fly away and towards a destructive reentry into the atmosphere. Maybe you'll catch it as a shooting star!

Italian translation of this logbook entry: [L-174: Prepararsi a quello che sarà un momento toccante in orbita](), by Paolo Amoroso—AstronautiNEWS.

L-173

The ATV liquid control panel. Credit: NASA

European Astronaut Centre (Cologne (Germany), 2014.06.04—One long refresher simulation for Sasha and myself today on ATV attached phase ops: everything that happens between the dynamic phases of docking and undocking, is the attached phase. In that time ATV is an integral part of ISS.

During those months of exploitation, crewmembers may be asked for example to initiate gas delivery into the ISS atmosphere from the ATV tanks, if that particular vehicle brought onboard air, nitrogen or oxygen. Other tasks involve the delivery of water from the ATV tanks to the big water reservoirs in the Russian service module. Once the ATV water tanks are empty, crewmembers might be asked to fill them up with urine from the smaller urine containers… although that's done less frequently nowadays that we recycle most of the urine onboard.

Today we also simulated preparing ATV for undocking. At the end of the mission, before departure, some items, like smoke detectors and lights, are removed from the vehicle and stowed on Station to serve as spares, since the same equipment is used in other modules.

In the picture you can see the interface panel with the valves that control fluid delivery. Before any operation, it's a good idea to check the label of the tank you will work with: if it already has an orange tag, it's not the right tank to get water from!

Italian translation of this logbook entry: L-173: Lavorate con i fluidi sull'ATV? Controllate le etichette!, by Paolo Amoroso—AstronautiNEWS.

L-168

Samantha Cristoforetti with the Kubik biological sample container at the EAC. Credit: Samantha Cristoforetti

Località italiana, 2014.06.09—It's vacation time! I'm enjoying some pleasant summer days in my home country, Italy, recharging the batteries before the final stretch of training.

Last training day before vacation was Thursday last week. I couldn't write a logbook, though, because there was a lot going on after training that day. For one thing, at the European Astronaut Centre we hosted the first in-flight-call with my fellow Shenanigan Alexander Gerst: lots of TV crews and media folks came to ask him questions for about 20 minutes. Alex looked great and already very at ease with weightlessness.

Afterwards I had a pleasant interview with my friends of Astronauticast - the very same gang of knowledgeable space enthusiasts who translate my logbook in Italian. If you understand Italian, here is the interview (right at the beginning of the podcast).

But I did have some training as well. For example I had a briefing on the

Kubik, a stand-alone unite of the European Space Agency, that provides a controlled temperature between 6°C and 38°C for living samples, like cell cultures. Thanks to a centrifuge insert, that you can see in the picture, samples can be exposed to variable accelerations, that can be set between 0,2G and 2G in steps of 0,1G. If samples just need to be exposed to a weightless environment, the centrifuge can be replaced with a passive insert.

The Kubik is a simple and cheap way of performing life science experiments on the Space Station.

Italian translation of this logbook entry: L-168: Kubik, una scatola che vi fa girare!, by Paolo Amoroso—AstronautiNEWS.

L-167

Samantha Cristoforetti with NightPod at the EAC in Cologne. Credit: Samantha Cristoforetti

Località italiana, 2014.06.10—The last training event last week was a briefing on NightPod, a system that interfaces with the still cameras on ISS to help astronauts with night photography.

As you probably know, taking pictures in low-light conditions requires longer exposure times. Even if the subject is not moving, it's hard to get a sharp picture without the use of a tripod, since the little shaking of the hand is enough to introduce blurring. A fixed tripod, however, is of little use when you're trying to photograph the Earth at night from the Space Station, because the target is moving fast in the field of view. You may try to rotate the camera to match the movement - and some people are quite skilled at that - but NightPod does it a lot better.

The system is mounted on a bracket in the Cupola, so that the camera faces the big nadir window. After initialization, the software asks for inputs regarding current altitude and attitude of the Space Station; based on that data it calculates the necessary rotation rate that needs to be imparted to the camera so that the target on the Earth surface looks stationary in its field of view. And there you go: you can have longer exposure times without compromising sharpness.

This will be my last logbook for this week of vacation. As always, see you on the other side!

Unless of course you'll join us in Cremona, Northern Italy, this coming Saturday for this event with my friends of WeFly [Italian].

And if you want to know more about WeFly, check out this past logbook.

Italian translation of this logbook entry: L-167: NightPod: inseguire la Terra per fare foto più nitide, by Paolo Amoroso—AstronautiNEWS.

L-156

The DSA 3 antenna of the ESA tracking station in Malargüe. Credit: ESA

Località italiana, 2014.06.21—Quello di oggi è un Diario di Bordo speciale, scritto direttamente in italiano, bypassando eccezionalmente il valido (e valoroso!) lavoro di traduzione di AstronautiNEWS.

Ufficialmente sono ancora in vacanza, quindi niente storie di vita da astronauta oggi. Prima di partire per Houston domani e riprendere il mio addestramento, però, voglio dedicare qualche parola al lancio di Avamposto 42!

Come sapete, si tratta del sito dedicato alla missione Futura, l'avamposto di Futura nella rete. Perché si chiami proprio Avamposto 42 l'ho spiegato qui.

Non esagero se dico che la nascita di Avamposto 42 per me è la realizzazione di un sogno, che coltivo ormai da un paio di anni. Se si è realizzato è perché ci hanno creduto in molti e sono loro davvero grata! È meraviglioso vedere come intorno ad Avamposto 42 si sia aggregato un gruppo di persone e di organizzazioni che condividono una visione comune: informare e appassionare, raccontare e coinvolgere, trasmettere e ascoltare, intorno ai due viaggi che iniziano insieme. Uno è la missione Futura stessa, l'altro un viaggio di consapevolezza nel mondo della nutrizione. Perché abbiamo un corpo soltanto, meglio conoscere le istruzioni per l'uso: è la nostra unica astronave per tutta la vita!

Naturalmente siamo soltanto all'inizio, diciamo che siamo nel warm-up. Aggiusteremo alcune cose, ne svilupperemo altre. Mi piacerebbe molto se partecipaste attivamente con le vostre idee e opinioni! Potete scrivere su Linea Aperta, ma anche @Avamposto42 su Twitter e la pagina Facebook Avamposto42 sono in ascolto. Le frequenze di comunicazioni sono aperte, nelle due direzioni.

Buon weekend!

English translation

Italian location, 2014.06.21*—Today's is a special Logbook, written directly in Italian, exceptionally bypassing the valid (and valiant!) translation work of AstronautiNEWS.*

Officially I'm still on vacation, so no life stories as an astronaut today. Before leaving for Houston tomorrow and resuming my training, however, I want to spend a few words to the launch of Avanmposto 42!

As you know, this is the site dedicated to the Futura Mission, the Futura outpost in the network. I explained here why it's called Avamposto 42.

I am not exaggerating when I say that the birth of Avamposto 42 for me is the realization of a dream, which I have been cultivating for a couple of years now. If it is realized it is because many have believed in it and I am really grateful to them! It is wonderful to see how a group of people and organizations that share a common vision have joined Avamposto 42: inform and excite, tell and involve, transmit and listen, around the two trips that start together. One is the Futura mission itself, the other a journey of awareness in the world of nutrition. Since we have only one body, it's better to know the instructions for using it: it is our only *spaceship for life!*

Of course we are only at the beginning, let's say we are in the warm-up. We will adjust some things, develop others. I would really like it if you actively participated with your ideas and opinions! You can write on Linea Aperta, but @Avamposto42 on Twitter and the Facebook page Avamposto42 are also listening. The communication frequencies are open, in both directions.

Have a nice weekend!

Italian logbook entry: L-156: Frequenze di comunicazione aperte, by Paolo Amoroso—AstronautiNEWS.

L-153

A scene from an IMAX movie shot on a Shuttle mission to repair the Hubble telescope. Credit: NASA

Houston (USA), 2014.06.24—Way to start a training week yesterday… after flying to Houston on Sunday, my Monday morning schedule took me to nearby Galvestion for a private screening of the IMAX movies Blue Planet and Hubble 3D. Sitting next to me in an empty theater, the people who made those movies, along with several other legendary IMAX productions from and about space: Toni Myers and James Neihouse.

I still can hardly believe it, but I will help make the next IMAX movie from space! Together with other crewmembers of upcoming expeditions, I'll do my best to make sure that the production team has the necessary footage to put together the next amazing movie experience of space for viewers all over the world. It doesn't get much more exciting than that!

Of course, it's not free fun, we need to go through the necessary training to be able to operate the equipment. Even more important, we need to understand how scenes have to be shot to be suitable for projection on the giant IMAX screens. That's why, even before being exposed to the dedicated still and video cameras we'll use on ISS, I watched a couple of movies with Toni and James, who did their best to help me see them from the perspective of the person behind the camera. What was great? What could have been shot better?

Looking forward to learning more from these experienced movie-makers. And I hope you're as excited as I am about a new IMAX space movie coming out - although we'll have to wait until 2016 to enjoy it!

Picture: a scene from the IMAX 3D movie, shot in space from the Shuttle cargo bay during a Hubble Space Telescope repair mission.

Italian translation of this logbook entry: L-153: Aiuterò a girare il prossimo film IMAX dallo spazio. No, veramente…, by Paolo Amoroso—AstronautiNEWS.

L-152

Samantha Cristoforetti trains in the Partial Gravity Simulator (POGO) at the JSC. Credit: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2014.06.25—Today was one of those training days when you quickly jump from one topic to another, as you run from class to class and from building to building at Johnson Space Center.

I started the day at the gym and then I headed to a robotics class with crewmate Scott Kelly, who will join us on ISS in March next year. It was a "track & capture" class: that's how we call the grappling of a free-flying visiting vehicle with the robotic arm of the Space Station. You can check this older logbook for some more words about.

After that I had a POGO class. That's the Partial Gravity Simulator, one of the training environments we have available to prepare for spacewalks. Interested in pros and cons of POGO versus training under water? Here's an older logbook about that!

In the picture you can see me in the POGO working on fluid lines, particularly on mating and demating the QDs. That stands for Quick Disconnects, but unfortunately they're not necessarily very quick. Especially the bigger ones have proven quite challenging to operate on orbit during spacewalks, with the fluid lines pressurized, because the hoses become extremely rigid! Since we don't have actual pressurized hoses under water, we train this in the POGO with the special QD trainer you see in the picture.

Afterwards I had a training class for the experiment Cardio Ox, in which I practiced taking an ultrasound of my brachial artery, my carotid artery and my heart, following the instructions of a specialist sitting in the next room.

Finally, a class called "Galley support", focused mostly on the nuances of the water dispenser. That's where we get potable water from, both to drink and to rehydrate food pouches. I tried my luck with a pouch labeled Italian vegetables. Not sure what was specifically Italian about them, but certainly a healthy food choice from the standard ISS menu!

Italian translation of this logbook entry: L-152: Stato di sospensione, by Paolo Amoroso—AstronautiNEWS.

L-152 Supplement

Samantha Cristoforetti and Scott Kelly are trained in the ROBOT software simulator for the capture of cargo vehicles on the ISS. Credit: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2014.06.25—I'd like to add a fun episode from yesterday's robotics class.

As I mentioned, it was a track & capture class for me and Scott. Somewhat different than usual, though, because we used the ROBOT software environment, in my case the first time I was exposed to it.

ROBOT is the system we use on the Space Station to practice capturing a vehicle in the days before a Cygnus, Dragon or HTV shows up on our doorstep. It consists of hand controllers, just like the ones of the real robotic workstation, and of three laptops, that reproduce all the command interfaces and all the camera views.

As Scott and I were practicing capturing Cygnus, our instructor Megan noticed that, on the TV screen, the NASA-TV images were showing Swanni and Alex on ISS doing exactly the same: practicing for the upcoming Cygnus capture on ROBOT. Nice coincidence!

On scheduled onboard practice sessions like these, instructors monitor from the ground, to provide real-time feedback. But crewmembers can also get extra practice on their own during their free time. Best of luck to the ISS crew for the upcoming Orb-2 Cygnus flight!

Italian translation of this logbook entry: [L-152: Diario di bordo – Supplemento: un episodio divertente con Scott Kelly](), by Paolo Amoroso —AstronautiNEWS.

L-150

Samantha Cristoforetti and the crew of the Soyuz TMA-15M train for CPR in the ISS mockup at the JSC. Credit: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2014.06.27—Yesterday Terry and I spent most of the day learning more about the IMAX project, that I wrote about on Tuesday. Turns out that it's not only about recording images, but also about properly capturing the sounds of the Space Station! Having spent a couple of hours listening to Greg talk about his job, which consists of putting the sound in movies, has likely changed my movie experience forever. There is so much work that I never even consciously perceived.

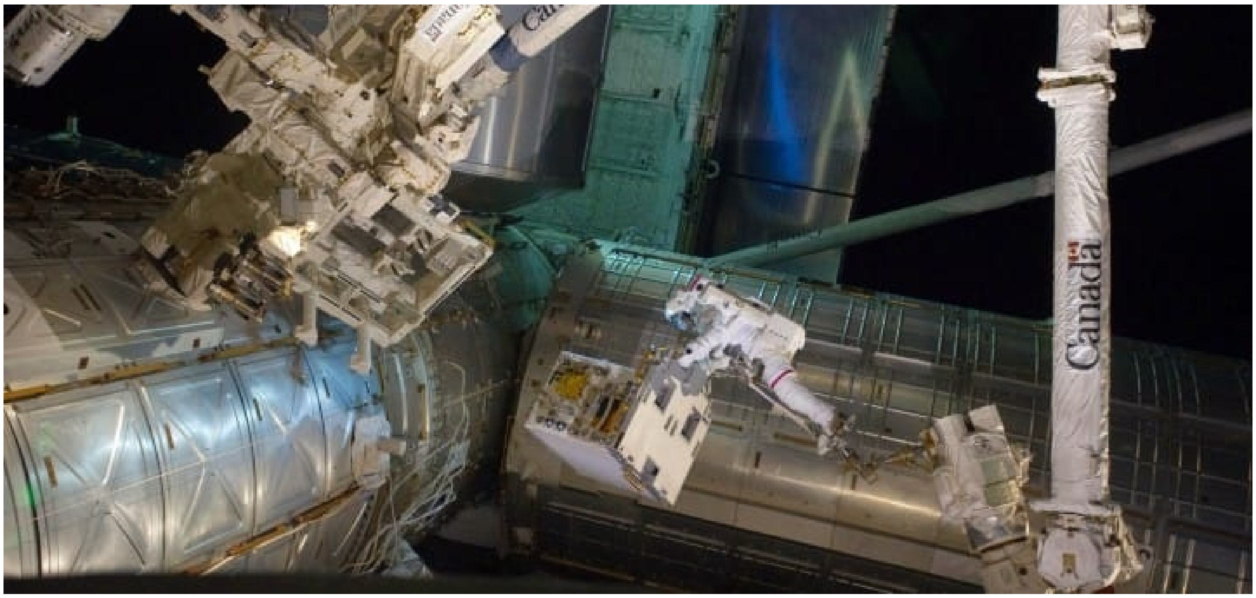
Later Terry and I had a familiarization class going through the so called Plug-in-Plan, which outlines what equipment is plugged into what electrical outlet on the Space Station and what are the restrictions and best practices for the crew to move stuff around, in the few cases in which we're allowed to do that without guidance from the ground (computers, small battery chargers, portable lights, ..). It might sound strange to you that it's such a big deal to plug something into a power supply, but Mission Control tracks the electrical load on each outlet, to make sure we don't cause any trip and, consequently, the unplanned shutdown of equipment or science experiments.

This morning our full Soyuz crew was reunited for a so-called Megacode class, in which we practice a correct rescue response in case a crewmate suddenly needs cardio-pulmonary (CPR) resuscitation. Starting chest compressions immediately and quickly getting a defibrillator set up might save a friend's life. In addition, we're also trained to insert an intraosseous device, basically a needle into the bone marrow, that provides a fast and reliable way to get life-saving medications into the blood stream.

Starting CPR immediately dramatically increases the chances of survival of a person whose heart stops beating, on Earth as well on the Space Station. I hope you're current on your CPR skills, you never know when you might be in the position of saving someone's life!

Italian translation of this logbook entry: L-150: Quando le compressioni salvano la vita di qualcuno, by Paolo Amoroso—AstronautiNEWS.

L-146



An EVA for replacing an ISS pump module. Credit: NASA

Johnson Space Center (Houston, USA), 2014.07.01—Yesterday we had quite a special training event in the Virtual Reality lab. Terry, Butch, Anton and I all joined in practicing one of the complex choreographies in which we use the robotic arm in support of a spacewalk.

In our scenario, Butch and Terry were initially the spacewalkers, which in the virtual reality lab means that they were wearing the glasses and the gloves and they were moving in the virtual Space Station scenario and interacting with it.

With glasses and gloves in the Virtual Reality laboratory. Credit: NASA

I was the robotic operator, and I could actually observe their virtual movement on my camera views. Anton was there to help mainly with camera panning, tilting and zooming, a role we call the Robotic Workstation Assistant.

In our scenario, we were dealing with a failed pump module, which had already been removed in a previous EVA and was temporarily stowed on the POA - this is like a robotic end-effector, but it's on a fixed position on Station. We are able to install a grapple fixture on a pump module so that the POA can attach to it.

First I took GCA instructions from Butch to maneuver the arm to a position where he could ingress the foot restraint which, in our simulation, was already attached to robotic end-effector. Check this older logbook if you don't know what GCA is.

Then I maneuvered him to the POA. Once Butch was in a position to get hold of the pump module handrails, we released the unit from the POA and I programmed an automatic sequence to get him to an external stowage platform, the final stowage location of the failed unit.

At that point we swapped positions: Terry got in the arm, virtually holding the pump module, and I became EV2, assisting in monitoring clearances and providing GCA instructions to insert the pump module in the guidance rails of its stowage "box" .

Virtual Reality lab is especially useful to practice coordination and communication, which are key to successful and smooth EVA/robotics combined operations. Moreover, the virtual reality environment provides a realistic reproduction of the lighting condition. At night, it can be very challenging to have a good view of the entire robotic arm and all the clearances!

Picture: an EVA crewmember handling a pump module in space a few years ago. Just like on our scenario, he's attached at the end of the arm.

Italian translation of this logbook entry: L-146: Addestramento robotico ed EVA al laboratorio di Realtà Virtuale, by Paolo Amoroso—AstronautiNEWS.

L-144

Samantha Cristoforetti with the respirator in a simulation of ammonia leak on the ISS at the JSC. credit: ESA / Corvaja

Johnson Space Center (Houston, USA), 2014.07.03—Remember how I have told you on several occasions about emergency simulations, both here in Houston as well as in Russia? See this logbook for example.

So far we had always only three-person emergency sims with Terry and Anton, my Soyuz crewmates. As you know, however, the Station crew is composed of six people. The crew of the Soyuz before us will be there when we arrive in November and will leave in March. At that point we will officially become Expedition 43. After a couple of weeks, we will be joined by a new Soyuz crew and we'll be back to a six-person complement.

So, yesterday we had a chance to practice emergency response with our first crew of six, Expedition 42, joining Butch, Elena and Sasha.

What's different with six people working the procedures? Well, in principle it is easier, because you have more crewmembers taking care of the different steps. But, as usual with teamwork, it's essential to have good coordination and communication, otherwise you'll end up making it worse by getting in each other way.

That's why before the sim Expedition 42 Commander, Butch, took some time to make sure that we all understood what our roles would be during the different emergency responses. For example, in a fire scenario I was going to have the main responsibility for working at the computer to find suspected fire locations based on the telemetry signatures and to perform the power downs as required. During the depressurization response I was going to carry one of the portable pressure gauges: we monitor it after every hatch closure and, if the leak is on our side, we recalculate our new reserve time in the smaller remaining volume.

Of course, an emergency response is a dynamic situation. We had a good plan going in, but we also always adjusted it real-time as required. That's perfectly fine, as long as there is a clear communication when you hand over responsibility of a task to somebody else.

I'm happy to say that our six-person team worked smoothly and efficiently together yesterday. A very good sign for our future time together on orbit!

Picture: ESA/Corvaja. On ammonia respirators after an ammonia leak.

Italian translation of this logbook entry: L-144: Il nostro addestramento alle emergenze in sei della Expedition 42, by Paolo Amoroso—AstronautiNEWS.

L-142

Samantha Cristoforetti in a simulation of loss of ammonia with the crew of Expedition 42 at the JSC. Credit: ESA / S. Corvajaa

Houston (USA), 2014.07.05—As I told you in the last logbook, this is emergency simulation time for us, with Expedition 42 sim last week and Expedition 43 sim coming up next week. Goal is to practice the emergency responses with our two full crew combinations of 6 people.

More than fire and depressurization, the one scenario that requires a no-kidding immediate response is an ammonia leak into the cabin. If you're wondering where that ammonia would come from, here's a little background on ISS design. All the equipment we have onboard generates a lot of heat, that we need somehow to get rid of. That's why we have cooling lines running throughout Station: via cold plates and the cabin heat exchangers, the water in those lines collects the heat. In the lines we have interface heat exchangers, in which the heat is passed from the internal cooling lines to the external ones. And in those latter ones, you guessed it, we have ammonia. Two external pumps make sure that that ammonia flows from the heat exchangers, where it collects the heat load, to the big Station radiators, where the heat is rejected into space.

So, you now know that there is a interface between the external ammonia lines and the internal water lines. What happens if there is a rupture at that interface, the heat exchanger? Well, since the external lines are at a higher pressure, it's likely that ammonia would flow into the cabin.

Ammonia is extremely toxic and has a very distinctive smell. However, if the leak is small enough, the vehicle autodetection system or the ground might notice it first, by observing an increase in the fluid quantity in the accumulators of the cooling system: since we're not adding any water, an increase in quantity must come from ammonia.

This is how our scenario started last week, with a call from the ground repeating this call on all frequencies: "Ammonia leak, execute emergency response! Ammonia leak, execute emergency response!"

I'll tell you in the next logbook how that response looks like… but it has a lot to do with the two types of masks you see in the picture (Photo: ESA/S. Corvaja)

Italian translation of this logbook entry: L-142: Fuga di ammoniaca? Ecco da dove verrebbe…, by Paolo Amoroso—AstronautiNEWS.

L-140

Samantha Cristoforetti performs the mask purification procedure in an ammonia leak simulation on the ISS. Credit: ESA / S Corvaja

Johnson Space Center (Houston, USA), 2014.07.07—In yesterday's logbook we were discussing an emergency scenario, in which we received this call from a simulated Mission Control "Ammonia leak, execute emergency response! Ammonia leak, execute emergency response!"

Since ammonia is highly toxic, the first action is to put on an oxygen mask. Throughout the ISS we have at least one mask, often two, in each module, ready to be used. US segment masks come with a bottle containing a 7-min supply of oxygen. That might not sound like a lot, but these masks are only used for initial response, as you'll see.

With the mask on, those of us who were in the USOS segment (US modules plus Columbus and JEM) quickly move aft to the Russian segment - that's not only because our Soyuz vehicles are docked there, but also because of one important design difference: there are no ammonia lines in the Russian segment.

Making sure that all six crewmembers are accounted for, we close the Node 1 hatch, thereby isolating ourselves from the USOS segment and the source of the leak. At that point we get rid of the external layers of clothes, potentially contaminated, and leave them in the PMA, the small adapter element between USOS and Russian segment, closing the PMA aft hatch as we retract into the Russian FGB module.

Time to retrieve our respirator masks and install on them the pink ammonia filter cartridges. Swapping from the O_2 mask to the ammonia respirators must be done quickly and carefully, since we don't know what the ammonia concentration in the Russian segment atmosphere is. Assuming a contaminated atmosphere, we keep eyes closed and hold our breath while coming off the O_2 mask. Once we have the respirators on, we go through a number of purging breaths to get rid of any ammonia inside the hood. Only then do we open our eyes.

Once everybody is safely on respirators, it's time to understand how much ammonia we have in the Russian segment atmosphere. For that we have a dedicated chip measurement system. In the worst case scenario, the Russian segment is contaminated to such a level that we need to evacuate Station. If the ammonia concentration is not so high, we can filter the air through our respirator cartridges via our breathing. We then stay for several hours, until the measurements show a safe atmosphere. In the lucky case that the air in the Russian segment was not contaminated, we could come off masks and breath normally. Safe, for sure, but with a lost USOS segment, at least for the moment.

Picture: going through the purging procedure (ESA/S.Corvaja)

Italian translation of this logbook entry: L-140: Ecco cosa fareste con una perdita di ammoniaca sulla ISS, by Paolo Amoroso—AstronautiNEWS.

L-139

Samantha Cristoforetti trains at the JSC for the Micro-5 experiment on infectious diseases. Credit: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2014.07.08—Yesterday Terry, Anton and I spent the morning in a five-hour routine ops sim, in which we got to practice daily activities like maintenance tasks, urine transfer, cargo ops. I've talked in the past about these types of training events, for example in this logbook.

In the afternoon I was trained on the experiment Micro-5, which will require a lot of crew activities in the Microgravity Science Glovebox (MSG). This is a sealed volume with built-in gloves in which you can operate on toxic substances or living samples without fear of contaminating the Station. In fact, as you can see in the picture, in its latest version you don't have to use the bulky rubber gloves, but can use regular lab gloves instead: the seal is made around your wrist.

The purpose of Micro-5 is to study the development of an infectious desease in space. Unfortunately, it has been observed that spaceflight induces both an impairement of the immune system of living creatures, as well as an increased virulence of pathogens. While both these phenomena have been studied separately, Micro-5 will study both by observing the development of disease in tiny "worms" (Caenorhabditis elegans) that will be infected with Salmonella bacteria in flight.

Training for this experiment was a lot of fun. Managing all those living cultures, mixing, separating, worrying about the sterility, carefully taking the samples.. all this in the peculiar MSG environment really made me feel like a scientist. Of course, I only went through the sequence once. In flight, I will have to do it dozens of time. By hey, as they say… scientific progress is 1% inspiration and 99% perspiration!

Italian translation of this logbook entry: L-139: Micro-5: osservare una malattia infettiva nello spazio, by Paolo Amoroso—AstronautiNEWS.

L-138

Samantha Cristoforetti assists Terry Virts for a session in the empty room at the JSC. Credit: NASA

Johnson Space Center (Houston, USA), 2014.07.09—Another busy day feeling like a scientist yesterday, training for several life science experiments, including one in which we'll work with small plants.

One last class late afternoon was dedicated to the preparation of my vacuum chamber run next week, working with a Class 1 EVA suit and gloves. Class 1 is the designation of hardware that is meant for use in space (as opposed to training). The gloves, in particular, will be my custom-made prime and backup gloves: if we find no issues with them in the chamber, they will be packed and sent to Russia to fly with me on the Soyuz.

On Monday I will have a dry-run: we will go through all the pre-EVA airlock procedures, but the depressurization will be simulated. As in prep-and-post classes in the past, we will instead pressurize the suit to the 4.3 PSI over ambient. Here's the story of a prep-and-post class.

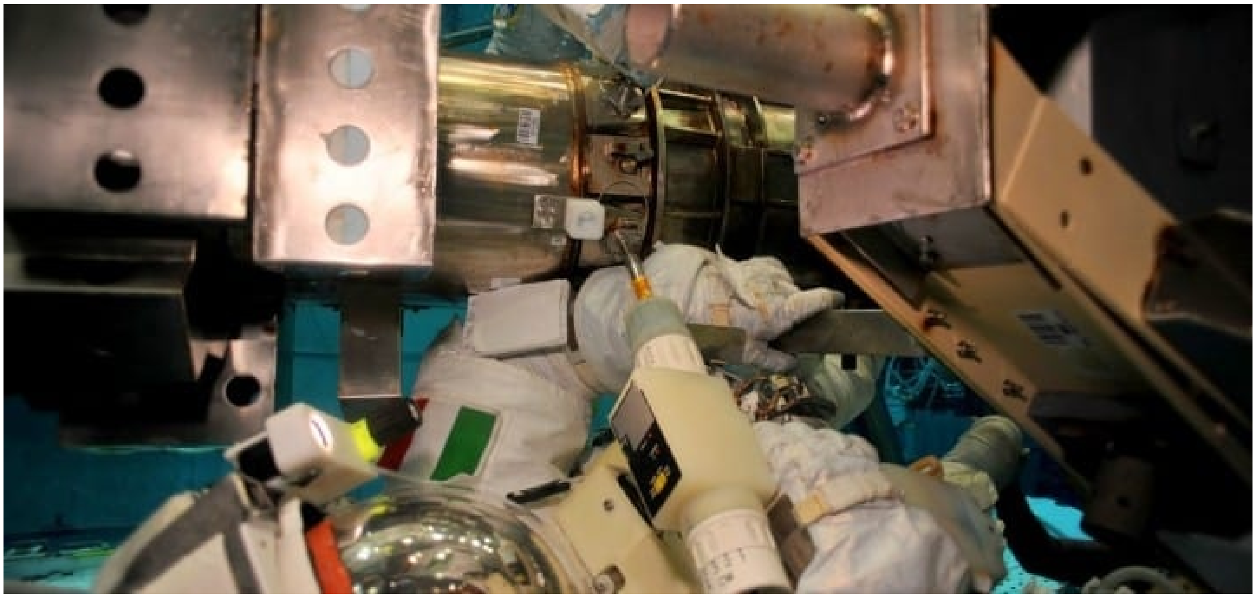
On Tuesday we'll have the so-called altitude run, in which we'll actually depressurize the chamber to almost vacuum. For this, we need to go through pre-breath procedures, purging nitrogen from the body to prevent decompression sickness as the pressure is lowered. The protocol used in the chamber is the 4-hour in-suit protocol, which is exactly what it sounds: breathing pure oxygen in the suit for 4 hours.The suggestion here is to bring one or two movies to watch through a small window in the chamber door!

By the way, this will be my first time in the vacuum chamber in the NASA EMU suit, but I had the chance a while back to do a chamber run in the Russian Orlan suit. Here is that story, if you missed it!

Picture: Terry's chamber run a couple of weeks ago. I helped suiting him up. (Credit: NASA)

Italian translation of this logbook entry: , by Paolo Amoroso—AstronautiNEWS.

L-131



Samantha Cristoforetti in an EVA simulation at NBL for the replacement of the Latching End Effector of the ISS robotic arm. Credit: NASA

Johnson Space Center (Houston, USA), 2014.07.16—SSorry for the long interruption in the logbook, but it's been a really busy training week here at the Johnson Space Center!

In the last logbook I told you about the upcoming vacuum chamber run, so first of all, if you're wondering how that went… well, we had to interrupt the altitude run yesterday because of a technical issue, so the event will have to be rescheduled. I'll tell you more soon!

But today let me tell you about the training day last Friday at the Neutral Buoyancy Facility, the giant pool in which we practice spacewalks underwater. With veteran spacewalker Randy Bresnick I practiced a LEE R&R. LEE is the Latching End Effector, the component at the end of the robotic arm that can capture a grapple fixture, for example on a cargo vehicle, and make a rigid connection with it. For some pictures check out this older logbook.

R&R stands for Remove and Replace: remove a failed unit, install a spare. So, the goal last Friday was to practice removing a failed LEE from the robotic arm and replace it with the POA - that's an end effector that is identical to the ones at the extremities of the arm, but it's located on the Mobile Transporter instead and is used to temporarily stow big units, if they have a grapple fixture.

There are some situations in which this swap would make sense, because an end effector might be degraded in such a way that it can not capture reliably a visiting vehicle, but it can still work fine as a POA for temporary stowage.

In this picture you can see all the POA just below the base of the robotic arm. As you can see, it looks just like the arm end-effectors.

Photo: removing one of the six bolts that attach the POA (or rather it's NBL mockup) to its install location on the Mobile Transporter. (Credit: NASA)

Italian translation of this logbook entry: L-131: Di nuovo in piscina per l'addestramento alle passeggiate spaziali, by Paolo Amoroso—AstronautiNEWS.

L-130

Samantha Cristoforetti trains to recognize water leaks in the EMU suit's helmet. Credit: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2014.07.17—Yesterday was the day of goodbyes… very special goodbyes. How often does it happen that you can say "See you in space in a few months?"…

First Terry and I said goodbye to Butch after one last robotics class together… next time we'll see him will be in November in MRM1, the Space Station module to which we'll dock our Soyuz. Later in the afternoon Sasha and Elena came to say good bye, joking that we'll see them at "customs control" before being allowed to enter Station.

These people have been part of my world for years - every time I was in Houston or Russia or Europe or Japan, depending how our respective schedules looked like, one or more of them could be "in town" at the same time. Well, we won't be in town together any more before we rejoin in space.

Butch, Elena and Sasha will leave in September, so I was expecting this moment to come soon. But amazingly enough, looks like I also said my good bye to Scott, whom I will see again on Station when he joins us next March. If we've recalled our schedules correctly, for the next four months we'll be dodging each other around the planet, arriving "in town" when the other has just left.

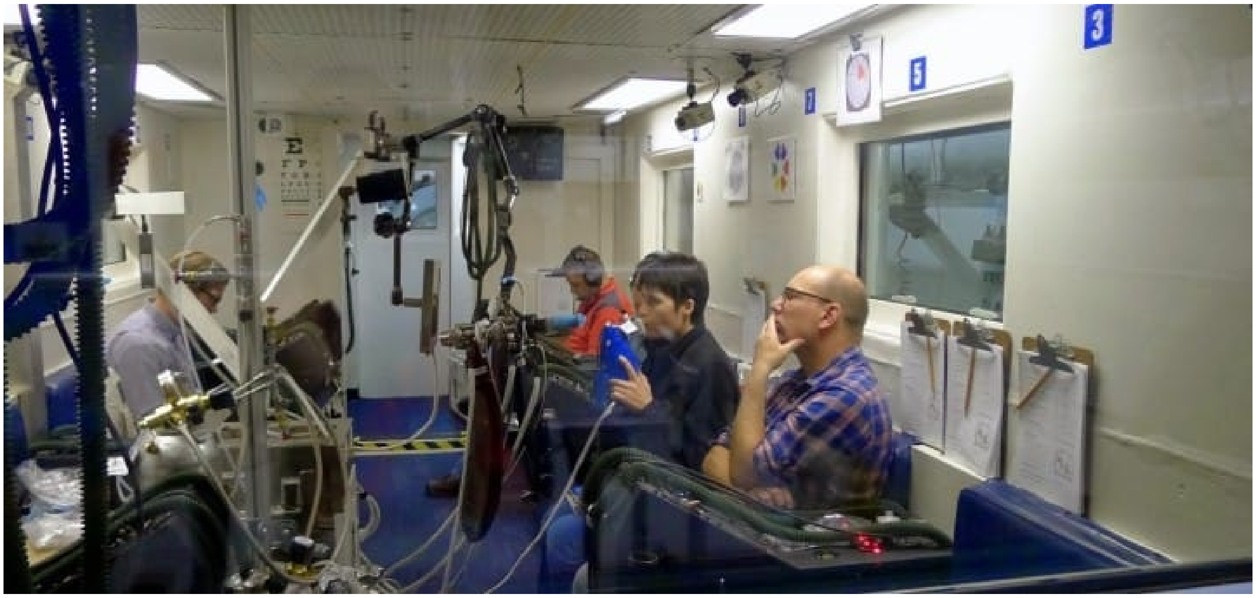
Besides giving bitter-sweet hugs, I had a full training day yesterday with many short events ranging from HAM radio to robotics, from retinal imaging to LAN troubleshooting. One very "different" event I had is the HAP sensitivity training. The HAP is the absorption pad we now apply in the helmet of a spacewalking suit to help mitigate the risk of a water leak event, like the one that happened to Luca last year.

Just like we have glove checks built in our EVA timelines to verify periodically that there is no damage, we now have periodic HAP checks, when crewmembers are asked to "feel" the HAP in the back of their head and report any changes. To get an idea of how it would feel to have the HAP loaded with different quantity of water we now have this HAP sensitivity training. We progressively added more water until, at about 150-200ml, I was confident that I would be able to feel that there is fluid in the HAP. Then we went to maximum capacity - about 600 ml and that's what you see in the picture. The HAP thickens significantly at that point and really pushes your head forward towards the front of the helmet.

Of course, we wouldn't let it go that far. We have procedures in place now to stop the accumulation of water in the helmet!

Italian translation of this logbook entry: L-130: Un giorno di saluti dolci-amari e… cuscinetti assorbenti, by Paolo Amoroso—AstronautiNEWS.

L-129



Samantha Cristoforetti in the hypobaric chamber at JSC for the baseline data collection of the Airway Monitoring experiment. Credit: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2014.07.18—Yesterday I had my second BDC (base data collection) session for the ESA experiment Airway Monitoring. You can find some information about the science background in this older logbook from EAC, where I had my introductory class.

Why do we need to gather pre-flight data on the ground? Well, if you need to understand the effect of weightlessness on a phenomenon, you need to observe it first in normal 1G conditions. Then you'll be able to compare that data with the data you collect in space and determine what changes are induced by microgravity.

In the case of Airway Monitoring, as you might remember, we're interested in studying the gaseous exchange in the lungs in two conditions: normal pressure and reduced pressure (10 PSI, that's about 2/3 of normal atmospheric pressure). In space we'll do the reduced pressure measurement in the airlock, that we will depressurize accordingly… but how do we do this on the ground?

That's what makes the Airway Monitoring BDC intersting: we do the BDC in a hypobaric chamber, a facility that is typically used for the hypoxia training that pilots, parachuters… astronauts periodically go through. In the chamber you can progressively reduce the pressure simulating flying to higher altitudes. The 10PSI we targeted are roughly equivalent to an altitude of 10.000 ft.

The first type of measurement is fairly simple: I need to exhale into an analyzer that will measure the nitric oxide (NO) content of my exhalation. NO is a marker of airway inflammation, but since there might be some NO in the air that I breath in, I also need to inhale through a scrubber that removes it. Now we're sure that any NO measured in my exhalation is really from my lungs!

The second type of measurement is a bit more complicated and is needed to understand the lung NO turnover: how much NO is actually diffused into my blood, instead of exhaled? That's where we need the Portable PFS facility: I inhale from a bag containing a known gas mixture (including NO and an inert trace gas) and when I exhale the central portion of my exhaled breath is collected in another bag and analyzed.

This experiment is exciting both from a fundamental science point of view, as well as for applications in space and on the ground. In terms of knowledge, it will improve our understanding of how lungs and respirations function. This will help in diagnosing and treating lung disease: think for example that over 300 million people worldwide have asthma and in some regions of the worlds the condition unfortunately is often not diagnosed.

For space exploration, it's really important to understand what happens to astronauts' lungs during long duration spaceflight. We are bound to inhale a lot of small particles that float in the air in microgravity, while on Earth they fall to the ground - just think of how fast dust can accumulate in your house (or at least it does in mine!)

Italian translation of this logbook entry: [L-129: Nella camera ipobarica: l'esperimento Airway Monitoring], by Paolo Amoroso—AstronautiNEWS.

L-128

Samantha Cristoforetti is trained in the APEX-03 experiment on plants. Credit: NASA

Houston (USA), 2014.07.19—Going through the photos of the past weeks, I found a couple from a brief training event on the APEX-03 experiment and I thought I'd share a few words on today's logbook.

This plant experiment uses as, a subject, Arabidodpsis Thaliana, a classic model plant for research. Since we know a lot about the molecular biology of Arabidopsis, it's the perfect candidate to observe what changes are induced by the spaceflight environment! In fact, gene expression has been shown to change in response to weightlessness, leading to modifications in root structure, growth and remodeling of the cell wall in space.

For APEX-03, seedlings of Arabodopsis will be flown to space in petri plates, wrapped in a dark cloth to prevent exposure to light before the experiment start. The plates will then be inserted into the Veggie facility for growth - and here is some info about Veggie.

Different samples will be allowed to grow for a different number of days, before crewmembers will photo-document the end state and perform the harvesting and fixation operations It's not a difficult task, but it does require some attention: the roots are very delicate and you really don't want to damage them when you pick them with forceps from their jelly-like nutrient substrate to insert them in the fixation tube (that you can see in the picture). One they're safely in there, you install an actuator and start to turn a handle to move a piston inside the tube. This floods the chamber containing the plant samples with a chemical preservative that freezes the molecular state of the plant.

Tubes are then conserved in the MELFI freezer until they can be returned to Earth for post-flight analysis.

Italian translation of this logbook entry: L-128: Piante, geni e spazio… scienza interessante!, by Paolo Amoroso—AstronautiNEWS.

L-122

Samantha Cristoforetti practices basic maintenance activities at Ellington Air Field. Credit: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2014.07.25—This was one of those weeks in astronaut training when I feel like a kid at summer camp. I got to spend three full days at Ellington Air Field, where NASA's T-38 fleet is based, training basic maintenance skills with the amazing mechanics who fix those jets and make sure they're safe to fly on. Great opportunity to refresh some skills and to learn many new tricks. Incidentally, I had a blast!

There's something fun and rewarding in mechanical work: I guess it's that combination of manual skill, knowledge about tools and materials and that basic human pleasure deriving from building something or repairing it.

Anyway, of course I wasn't there for my entertainment. We do a lot of maintenance work on the Space Station. It's an extremely complex vehicle and the equipment does require periodic preventive maintenance and, occasionally, corrective maintenance to recover from a failure. The

ISS training flow includes a number of maintenance classes, in which we get familiar with the tools we have onboard, the way maintenance procedures are written, what the ground controllers expect in terms of reporting and interactions and some typical maintenance activities.

This Field Maintenance Training is a fairly recent addition and is meant as an immersive experience, in which you get a lot of hands-on practice and.. well, you learn from the best. It's actually a two-week course, but unfortunately there is no way we could find two weeks in my schedule right now, four months from launch. But since I was really keen on doing is, the course is very flexible and I have stellar schedulers, I was able to participate for three intense days.

The first day I was in the avionics workshops, practicing soldering skills, multimeter use and working on electrical connectors, for example removing or installing pins. The rest of the time I shared between the battery and sheet metal workshops, practicing things like drilling, tapping, riveting, metal bending, removal of bolts with a stripped head… This latter one, I really hope it doesn't happen on ISS: trying to drill through a steel bolt is not fun even on the ground, must be very challenging in weightlessness!

Last time I did something like this, I was 19-year-old and I was doing a 6-week metal work internship in a mechanical apprenticeship workshop in Munich, a requirement to start my engineering studies… I would have never thought that, 18 years later, I would be practicing cutting threads with manual tap-and-die sets as an astronaut, to possibly do it on the Space Station. Isn't it cool?

Picture: trying to take picture of a poorly accessible and poorly illuminated detail. Ground controllers are the second pair of eyes for our ISS maintenance tasks… but since we can not bring them up there, it's really important to be able to photo-document our work.

You can find more pictures here.

Italian translation of this logbook entry: L-122: Usare il trapano, saldare e riparare i connettori elettrici…, by Paolo Amoroso—AstronautiNEWS.

L-118

The toilet in Node 3 of the ISS. Credit: NASA/Expedition 31

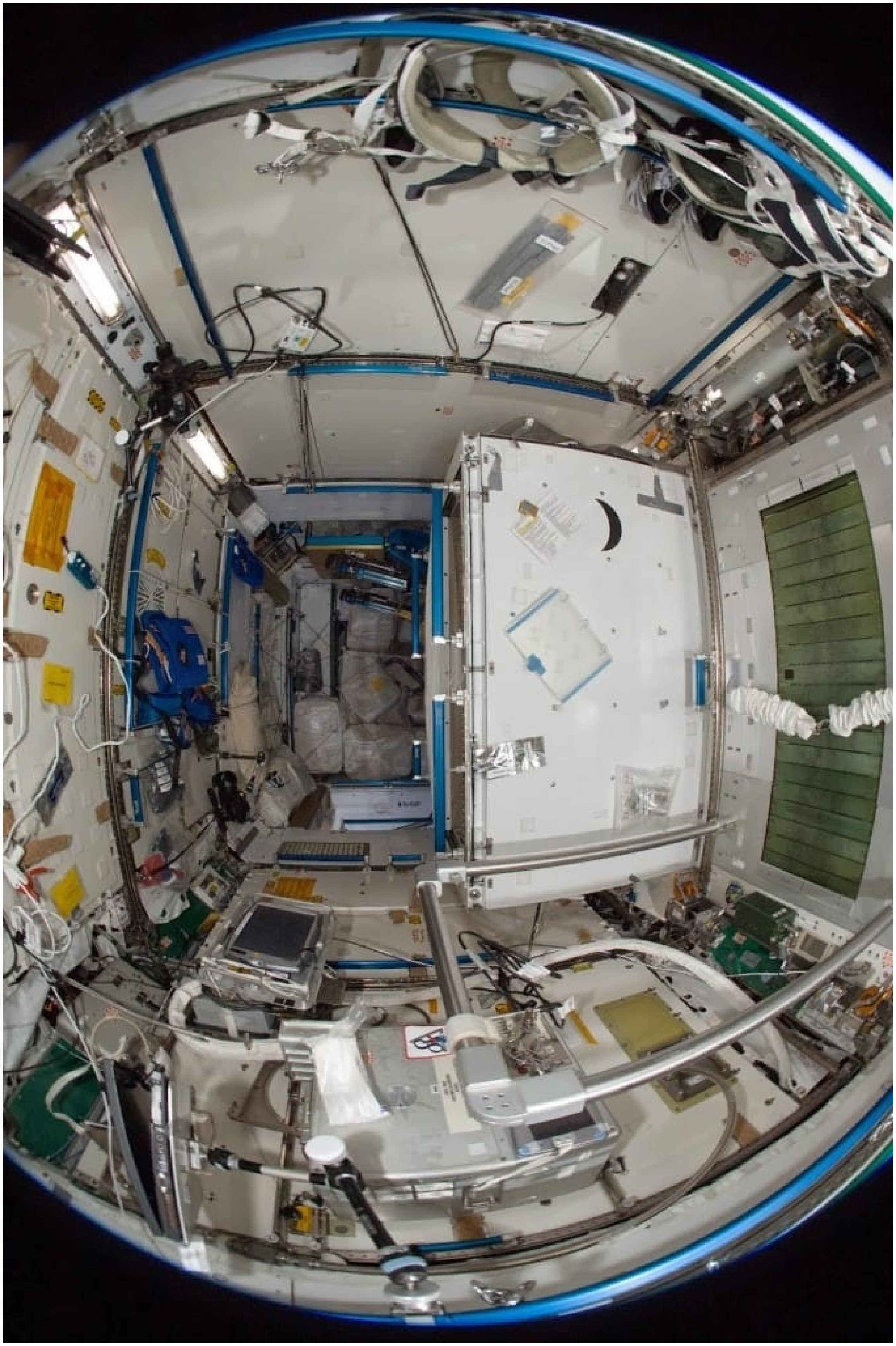
Star City (Moscow, Russia), 2014.07.29—Back in Star City, after returning to Europe from Houston and following a brief stopover at home on the weekend.

Time to dive back into the Soyuz world, at least for the next three weeks! But first, I'd like to talk to you about one last class I had at the Johnson Space Center last week, before leaving Houston.

It's a non-mandatory class that crewmembers can request if they feel the need to review one of the most important pieces of equipment on-board, and likely the first one I'll want to use after my arrival. It's the Waste and Hygiene Compartment (WHC): for friends, the space toilet.

The WHC is contained within a standard rack, one of the tiltable elements that are installed next to each other along the four walls of any USOS module. All the components - pump, fan, pipes, tanks, filters, etc. - are hidden behind the panels. In front of the panels, but still contained in the standard rack volume, are the user interfaces: a yellow funnel with a flexible tube for the urine and a solid waste tank with a hole in top, on which a "seat" is mounted.

In front of the rack, sticking out into the free volume of Node 3, is the WHC cabin, which provides some privacy.



The toilet in Node 3 of the ISS. Credit: NASA/Expedition 31

The WHC has a control panel with enough switches, buttons and LEDs to make you think Japanese toilets are boring (they're not). In fact as a user, when you step in, you want to glance over the main panel to make sure the lights reflect one of the expected configurations. It's either three or four green LEDs, depending on where the urine is going. Most of the time the urine flows directly to the Urine Processing Assembly to be treated and then is sent on to the Water Processing Assembly to be turned into potable water. However sometimes, for example if the UPA is undergoing maintenance, the urine can be directed to a removable tank instead.

As you can imagine, the panel also has a number of red lights that can come on and indicate a malfunction or simply the need of some action: replacing a full urine tank, for example; or refilling the flush water tank.

The whole system is based on airflow carrying liquid and solid waste away from the body and into respective collection tanks. Therefore, the first thing we do to use the toilet is to turn on the fan that creates that directional airflow. Urine is collected via a funnel and is mixed with flushing water and a chemical agent before being sent to the UPA or the tank. Solid waste is collected in single-use bags installed in the solid waste receptacle - after every use, a new clean bag is prepared for the next user, while the expended one needs to go into the tank just below the "seat". On Earth, it would just fall down. In space, it takes some guiding: granted, as I hear, not the most glamorous part of living in space.

You probably guessed that the one malfunction that could potentially create a real mess is a power loss during use, since the airflow would stop and there would be nothing pulling the waste in the right direction. The immediate action: close the "seat" cover and cap the liquid waste receptacle! Then you can worry about the rest of the troubleshooting.

Photos: NASA/Expedition 31

Italian translation of this logbook entry: [L-118: La prima cosa che cercherò arrivando sulla ISS](), by Paolo Amoroso—AstronautiNEWS.

L-116

The BCAT experiment on colloids of the ISS. Credit: NASA

Star City (Moscow, Russia), 2014.07.31—Just got back from a briefing about the fire simulation I'll have in the afternoon with Anton and Terry. We had this type of training once already last year, during our backup flow, as I reported in these two logbooks from last December: L-348 and L-345.

Since I've told that story already, let me dedicate a few words to an experiment I trained for in Houston couple of weeks ago and I didn't tell you about yet. It's called BCAT, which stands for Binary Colloidal Alloy Test.

A colloid is a special type of solution, in which tiny particles, so small that you can not see them with the naked eye, are dispersed evenly in another substance. Foam, for example, is a type of colloid: small gas particles are trapped in a liquid or a solid. If it's liquid particles dispersed in a liquid, we talk about emulsions: milk is a common example.

Several runs of BCAT have been performed on ISS already. This particular one, BCAT-KP (Kinetic Platform), is interested in phase separation kinetics. You've heard about phase changes in school, I'm sure: we all learned about transition of substances between their solid, liquid or gaseous phase (ice, water and water vapor, for example). Now, phase changes in colloids are a lot more complicated. They are also very interesting both from a fundamental science point of view, as well as for immediate commercial applications (detergents, pains, inks, medicines, …). In fact, a major private company owns some of the BCAT-KP samples! Better insight into colloids could lead to new ways of producing plastic or help extending the shelf-life of some consumer products.

Let's say we're interested in the stability of a colloid: how long will it take for the dispersed particles, interacting with each other, to gather together, separating the two phases? What kind of structures will those particles form? These are only a few of the questions scientists are interested in. And although we've been studying colloids on Earth for a long time, there's a lot we still don't know because, guess what, gravity-induced effects are stronger than the interaction between particles, for example the electrostatic interactions. Basically, if the particles are denser that the substance they're dispersed in, they will migrate to the bottom - that's called sedimentation. If the opposite is true, they will migrate to the top - and that's called creaming.

None of that happens in space!

The BCAT experiment consists of a unit that can hold 10 samples, tested one by one. When it's time to get one started, crewmembers will use a magnet to homogenize the sample, i.e. mixing it so that the dispersed particles are evenly distributed. Then [they will set up a camera](), so that it will automatically take a picture at a preset interval and download it to the ground for analysis.

Each sample is observed for one week and it's very important not to bump the unit while the experiment is running. That's why BCAT is setup in an area of little passage, tucked between the JEM airlock and the forward wall.

Italian translation of this logbook entry: [L-116: Conoscete i colloidi?](), by

Paolo Amoroso—AstronautiNEWS.

L-115

Samantha Cristoforetti in Star City in a simulation of evacuation of the ISS for the contamination of the atmosphere in a fire. Credit: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2014.08.01—As I have mentioned, yesterday Anton, Terry and I had a chance to repeat the fire evacuation simulation as part of our proficiency training as prime crew. I had talked about our first sim last December. (See L-345 Logbook)

One of the things that changed, for the better, since we did this in our backup flow, is that we now have an improved oxygen mask on the Russian segment. To understand how it got better, it's useful to know how it actually works. Please refer to the picture. The Russian ИПК mask is a self-contained system, so no filtering involved here. The greenish container connected to the mask itself via a tube contains a substance that will chemically react with your exhaled breath to remove CO_2 and add oxygen.

When you are ready to put on the gas mask, you need to take a deep breath and hold it during donning. Then you exhale into the mask to get the reaction in the container started. The exhaled air goes through the chemically active substance into the bag, when you inhale you will pull that back into your lungs. You'll know that somebody is breathing properly through the mask because you'll see the bag inflating and collapsing with exhalations and inhalations.

If you happen to squeeze the air out of the bag, you'll not be able to take the next breath. Most likely you've pushed that air into the hood, so you need to lift the mask off your mouth, breath that air back in from the hood volume and exhale it back into the bag to get back to your normal cycle.

The chemical reaction is exothermic, so the air gets quite warm. And here's the big improvement since the previous model: there is a heat exchanger (the little metal element half way down the tube) that cools the air down to about 37°C, a lot cooler than it user to be. Impressive what a difference it made in our comfort level yesterday!

The Russian mask is supposed to last between 20 and 140 min, a wide range that considers different people's size and different activity levels. On average, it will last about 40 min.

As a comparison, in the USOS segments we have masks that come with their own small oxygen tank. They're are a lot quicker to don and more practical to wean and do work in, but you will run out of oxygen in about 7 min. If needed, you could connect them via a cable to the Station oxygen ports, although that does limit mobility. I'm wearing one of those masks in this picture.

Picture: donning the Sokol suit while wearing the gas mask. Simulating contaminated atmosphere and evacuation of ISS due to ongoing fire.

Italian translation of this logbook entry: L-115: Come funziona la maschera antigas… e come è migliorata!, by Paolo Amoroso—AstronautiNEWS.

L-110

Samantha Cristoforetti tests her Sokol suit at the Zvezda facilities. Credit: Gagarin Cosmonaut Training Center

Star City (Moscow, Russia), 2014.08.06—Prime flow training in Star City continues with a lot of proficiency events in the various aspects of the mission on Soyuz and Russian segment of the ISS. I have regular sessions of manual flying, both docking and descent. I've written those stories in past logbook, for example: L-357 and L-223

Periodically I have review classes on the various systems, which are also an occasion to cover any recent changes. And of course Terry, Anton and I spent quite some time in the Soyuz simulator.

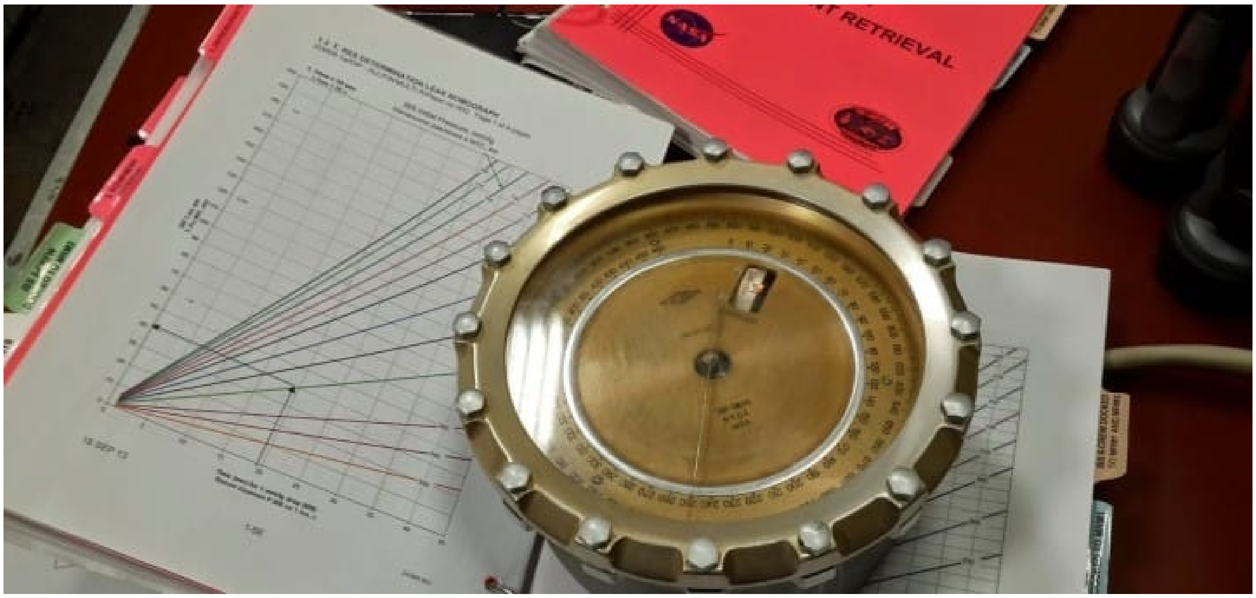
Yesterday, I had one final visit at Zvezda, the company that manufactures the Sokol suits, the seat liners and all the survival suits and clothes for cold-weather and for water landing. Nothing has changed on my Sokol since I wore it last time in Baikonur, but this final check can catch any changes in the crewmember's build. Since my weight has stayed the same, we just did a quick verification. It was actually really good to be in my own Sokol again: since I'm small, in Star City I typically get somewhat bigger suits for training. It's good to be reminded of the challenges of donning and doffing a suit that is actually my size!

Talking about donning the suit, in this photo-album I explained step-by-step how that works.

Now getting ready for a six-hour Soyuz sim: no shortening and skipping of not-so-interesting portions of the flight profile today, we'll actually fly a nominal timeline from launch to docking.

Italian translation of this logbook entry: L-110: Un’ultima volta nella mia tuta Sokol prima di Bajkonur, by Paolo Amoroso—AstronautiNEWS.

L-108



The pressure gauge and the graphics used at Star City in ISS depressurization simulations. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.08.08—Just got back from a manual docking session and now it's time to get ready for a 4-hour Soyuz sim in the afternoon with Terry and Anton: we'll practice undocking and reentry and I'm sure that, as usual, we'll have plenty of malfunctions to keep us busy!

Yesterday we spent the afternoon in the Russian segment mockups for a 4-hour emergency sim in which we worked through five depressurization scenarios with different leak locations and leak rates. In one of the scenarios, the leak was in the Soyuz descent module: in such a case, we would have to run a procedure to prepare the Soyuz for unmanned undocking and reentry, before closing the hatch and let it depressurize to vacuum. Until a rescue ship could be sent, we would be effectively "stranded" on ISS.

In another case, the leak was in the Service Module, requiring us to abandon the heart of the Russian segment, but also forcing the crew docked to the MRM2 module (that would be the other 3-person crew) to leave the ISS - with the Service Module depressurized, they would be cut off from their Soyuz if they stayed.

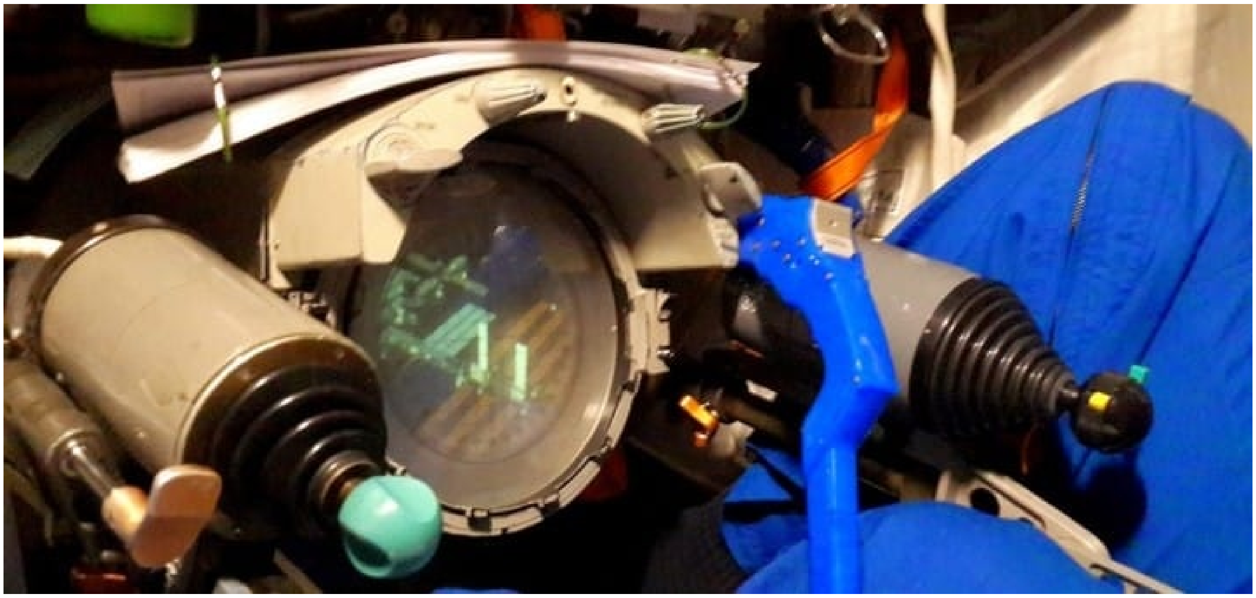
You can read more about finding a leak in this logbook from our vacuum chamber depressurization training.

In the picture you can see the main pressure instrument we use during a depress scenario: it's portable and it's more precise than all other sensors we have on station. We call it with the Russian acronym MV (MB = мановакуметер).

In case of a depressurization alarm, given manually by the crew or automatically by the onboard computers, the vehicle autoresponse shuts down all ventilation and, in the Russian segment, starts an algorithm to try and pinpoint the leak by using the data from the airflow sensors located in the hatchways. That takes about 5 minutes, during which we retreat to our respective Soyuz ships to avoid affecting the airflow and, since we're at it, to check that it's not the Soyuz itself that is leaking. We also immediately calculate our reserve time, which is the time we have available until the pressure becomes to low and we have to evacuate. The Russian computers and the ground controllers will compute the reserve time as well, but we do our own rough calculations by using the graphs you see in the picture, which are based on the time it takes for the pressure to drop 1 mm.

Italian translation of this logbook entry: L-108: Depressurizzazione… quando c'è una falla sulla ISS, by Paolo Amoroso—AstronautiNEWS.

L-103



The view from the periscope in a simulation of the crew of the Soyuz TMA-15M. Credit: Samantha

Star City (Moscow, Russia), 2014.08.13—It's a beautiful summer week here in Star City and Terry, Anton and I are keeping up our proficiency in all thing Soyuz. I've had training sessions in manual approach, manual docking and manual descent and today we were all three back together in the Soyuz simulator.

We flew a rendezvous and docking profile, the first time as part of a nominal flight, which takes 6 hours (4 orbits) from launch to docking. The second time we simulated having transitioned to the old two-day flight profile because of some malfunction.

If you're wondering what we would be doing for two days, waiting to rendezvous with Station… well, I'm not sure how we would decide to kill the time, but one thing is certain: most of the time we would be spinning! In fact, when there are no dynamic operations (i.e.: there's no need to fire the thrusters or the main engine), the Soyuz is put in gyroscopic stabilization with the solar panels pointed at the Sun to maximize power generation. It's actually not the greatest thing for the crew: any space sickness you're experiencing, the spinning is guaranteed to make it worse (or to give you symptoms, if you didn't have any). But unless you actively stabilize the attitude with thrusters, the only way to keep a stable orientation is to rotate on an axis.

Btw, I've explained this a little bit more in this post from - wow! - almost three years ago (I have been studying the Soyuz for a while, haven't I?)

Is there anything odd/weird/unique that still sticks out in your mind when you think about training on the Soyuz?

David Anders Interesting question, thanks!

I guess something that really surprised me about the Soyuz when I realized it is the fact that the navigation system of the vehicle is completely turned off after every dynamic phase (when you use the propulsion system).

Before every burn, be it a correction burn or a reentry burn, navigation sensors are turned on and the vehicle rebuilds orientation along the local vertical and the velocity vector. The crew practices a lot doing that manually for the unlikely event that the automatic system fails.

Between dynamic phases the Soyuz is oriented with the solar panels towards the Sun to recharge the batteries and supply power to on board systems. Then the vehicle is put into a spin around its axis for gyroscopic stabilization. It will fly around the Earth maintaining its solar panel towards the Sun This so called "solar orientation and rotation" is typically done manually by the crew using the rotational hand controller on the upper right corner of the picture below.

In the Soyuz simulator. The rotational manual control is in the upper right corner. Credit: Samantha

In the picture you can see the periscope view in the simulator as we were approaching the ISS. Looks like we were at a distance of about 200-250 meters: at that point we would be doing the fly-around to align ourselves with the docking port. The computer is still flying the approach, but the hand controllers are in the working positions (they're pulled out before approach start), so that Anton can reach them if it's necessary to transition to manual control.

Italian translation of this logbook entry: L-103: La Sojuz vi può far girare la testa!, by Paolo Amoroso—AstronautiNEWS.

L-102

Samantha Cristoforetti and the crew of the Soyuz TMA-15M in the simulator. Credit: Samantha Cristoforetti

Star City (Moscow, Russia), 2014.08.14—Back in the Soyuz sim today with Terry and Anton, this time wearing the Sokol and set to practice an emergency descent after undocking.

These scenarios are always very intense but, on the other hand, somewhat shorter than a normal descent, because we rush to make an early opportunity to turn on the engine for a braking burn, about 40 min after opening the hooks to undock from ISS.

Today we started out with a leak in the Soyuz, to which we added a second failure that, in itself, would lead to an emergency descent: a depressurization of the high-pressure helium lines. There are no pumps in the Soyuz propulsion system: it's a simple and robust design that uses high-pressure helium to pressurize the propellant tanks. If the helium starts leaking, we need to turn on the engine before the pressure becomes to low for the deorbit burn.

So, with a leaking descent module and leaking helium tanks, we were all set for a ballistic reentry using Program 5, which I have explained in this previous logbook.

Except that Dima, our evil instructor, also threw a main computer failure at us, so we had to revert to flying our ballistic reentry in the so-called "analog loop" - it's the older computer from the previous Soyuz series, which leaves a lot of work up to the crew and has a lot less built-in automatic checks. Main thing: you need to build the attitude and turn on the engine manually and, if the engine fails, you need to manually shut it down and turn on the backup thrusters.

We had an engine failure so early on in the burn today that we burned on the backup thruster for over half an hour (instead of the nominal 3 min and 41 seconds) and we ended separating from the service module by thermal sensors, instead of by command… how that works, is a story for another logbook!

Italian translation of this logbook entry: L-102: Se il motore della Sojuz perde elio… non è un buon segno, by Paolo Amoroso—AstronautiNEWS.

L-100

Samantha Cristoforetti and her crew in front of the Baikonur ramp before the launch of the Soyuz TMA-13M. Credit: NASA

Star City (Moscow, Russia), 2014.08.15—100 days to launch! Yes, I know… yesterday's logbook was L-102: what's going on?

No, the launch date has not changed, it's still on November 24th. But at 1:57am Baikonur local time!

That means that it will be the evening of November 23rd in Europe, which is home to me, my family and a great part of my friends. It will be early afternoon in the US and late evening in Moscow. And it will even be November 23rd on the Space Station, which operates on GMT.

Even more importantly, when we will get up in the morning (late morning) of November 23rd, it will effectively be launch day! Our last night on Earth for six months will be behind us and we'll only go back to sleep for a short nap in the afternoon, before embarking on our great adventure. Considering all that, I decided that today is L-100!

Can't wait to go back to Baikonur and get ready to fly to space. The team down there is already working on our Soyuz ship: you can see a lot of them in the picture, taken a few minutes after the Exp 40 crew (Max, Reid and Alex) had waved us good bye from launch pad stairs last May. Next time we will not be in the picture. Or maybe we will, if they will include the top of the rocket!

More picture from our backup-crew time in Baikonur are here.

Italian translation of this logbook entry: L-100: Fra 100 giorni volerò nello spazio con Terry e Anton!, by Paolo Amoroso—AstronautiNEWS.

L-79

ISS solar panels. Credit: NASA

Johnson Space Center (Houston, USA), 2014.09.05—First of all, I apologize for the long silence. I never meant to have such a long break in the logbook, but things have happened on the private side of life that just took priority.

So, now I am back, working at full speed to a launch date that is now, wow, only 79 days away!

Since my last logbook I have had brief trips to Japan and to Europe that included some refreshers on the JEM and Columbus systems respectively, but mostly training on the JAXA and ESA experiments that I will perform during my stay on ISS. I'll try to catch up on that in some upcoming logbook.

Now 'm back in Houston for my final few weeks of training at the Johnson Space Center. As usual, training here is extremely varied: yesterday was my first day and I had a phlebotomy class, a few brief classes on the experiments Body Measures and Salivary Markers, a consultation class on the Environmental Control System, a proficiency class on the onboard application we use to locate a hidden fire and a couple of IMAX classes, including a trip to the Galveston IMAX theatre to watch footage that I recorded with Terry back in July.

Today, Terry and I said our final goodbye to procedure 2.600, at least in terms of training. And I certainly hope we will not use it on orbit, though you never know! The infamous 2.600 is the "Unknown EPS bus failure" procedure, with EPS being the Electrical Power System. It's meant to cover a major power loss, which could potentially affect communication with the ground: that could happen because the communication systems loose power or because we loose ISS attitude control or simply pointing data (so the antennas don't know where to find the communication satellites). Or a combination of all those things. Moreover, with a major power bus loss we could partially loose internal and/or external cooling, which would put us on a so-called thermal clock: within a few hours, some components would start to overheat.

As you might imagine, the ISS has a lot of self-protection features: they are called FDIR (Fault Detection Isolation and Recovery). The problem when you have a major power bus loss, like we had today in our scenario, is that you might loose power to the computers that are responsible for the FDIR response: for example the computer that would normally recover communication to a backup string.

Slowly but certainly, the ISS main computers, the ones at the top of the hierarchy, will bring online backup units for all the lower level computers, according to a predetermined priority sequence. But full recovery might actually take a full hour and crew intervention is still required to make sure that the Station is brought to a safe configuration, especially in terms of cooling.

In our scenario today the very first priority was to recover attitude control by putting the Russian GNC computers in charge (GNC = Guidance, Navigation and Control, which includes keeping the ISS in the proper orientation). As soon as the Russian computers gain attitude control, they immediately fire the thrusters to bring the ISS back to its nominal attitude along the local vertical and the velocity vector. You may wonder why that transition to Russian control doesn't happen automatically in case of loss of attitude. Well, the problem lies with the solar arrays: they track the Sun and they could be oriented in such a way that thruster firing might damage them. So we first need to bring the solar arrays to a fixed, safe position: one of the things that 2.600 will guide you to do!

Italian translation of this logbook entry: L-79: L'ultima esecuzione della famigerata 2.600… si spera!, by Paolo Amoroso—AstronautiNEWS.

L-75

Samantha Cristoforetti and some crewmates on an expedition to Alaska in 2012. Credit: Samantha Cristoforetti

Johnson Space Center (Houston, USA), 2014.09.09—This week has started with a lot of events that really drive home the point that we are flying to space soon!

How about a meeting with the ISS program management yesterday? Or a four-hour brief with the flight control team on the current state of the ISS systems? Or being given our official "crew notebooks", certified to fly to ISS? Or having my pre-flight on camera interview this morning?

And talking about lasts, I'm also carrying around a cooler for my final 48-hours urine collection… definitely one of the least glamorous and pleasant aspects of astronaut training!

Hey, today is also a big anniversary for our crew: exactly two years ago we started our NOLS expedition in Alaska. That's when Butch, Terry and I first got to really know each other. Kimiya and Kjell, who shared that adventure with us, are now our backup crew. Hal is now the Exp 43 lead

CAPCOM, while Thomas is still our Exp42 Lead Flight Director!

I shared a little bit of that story here.

Italian translation of this logbook entry: L-75: Due anni fa: la nostra spedizione in Alaska!, by Paolo Amoroso—AstronautiNEWS.

L-70

Samantha Cristoforetti, Anton Shkaplerov and Terry Virts in a simulation Prep & Post EVA. Credit: Samantha Cristoforetti

Houston (USA), 2014.09.14—It's been a week of many lasts. That's the way it is when you are at L-70!

On Friday I had my last 1G bref in preparation of - you guess it - my last NBL run next week. And on Thursday I had my last SAFER class.

You can read some more about SAFER training here. But actually this last class was a bit different because we tried the virtual reality setup that we have on ISS, which is used to practice SAFER rescue scenarios, but also to review a timeline in 3D before performing it on a spacewalk. Here's a picture of how it looks like!

And on Wednesday Terry and I had our last full-day Prep & Post class, reviewing the airlock operations conducted before and after a spacewalk. Believe it or not, it's been almost three years since my first Prep & Post class: I have pictures from that event dated October 2011. At that time I wasn't assigned to an ISS expedition, but I was training as though I was, having been designated ESA's reserve astronaut. Regan, our Exp 42 lead EVA systems instructor, actually taught me that class back in 2011: I can safely say he's taught me all I know about the EMU suit and the airlock operations.

Normally in a Prep & Post class we would pressurize the suits and devote some serious training time to the pre-breath protocols. I have explained a bit about that in this previous logbooks: L-470 and L-390.

On this last class, however, we did not pressurize and we focused instead on a thorough review of all the procedures. But the main goal was to make the most of a few hours in which we had a special guests, our Soyuz commander Anton. In the past, when we had only three people on ISS, cosmonauts were fully trained on the EMU and non-Russians were fully trained on the Orlan. After we started having 6 crewmembers onboard - three Russians and three non-Russians - the ISS moved to separate operations, in order to optimize training time, so everybody gets training only in "their" suit and spacewalk procedures. As ESA astronauts we are a bit of an exception, in that most of us (including me) are qualified both on the EMU and on the Orlan.

As you probably know if you've been following this logbook, suiting somebody up in the EMU is not such an easy task and having two extra hands to help is definitely desirable. Having Anton get hands-on on the EMU last week, helping in the suit-up process, will definitely pay off if he needs to help us on orbit!

Our second special guest was NASA astronaut Karen Nyberg, who gave us a lot of valuable tips based on her experience of actually running airlock operations on ISS just last year.

Italian translation of this logbook entry: L-70: Ospiti speciali per me e Terry in una settimana di ultime volte, by Paolo Amoroso—AstronautiNEWS.

L-61

Samantha Cristoforetti in tuta EMU assistita da Terry Virts per una sessione in camera a vuoto. Credit: NASA

Johnson Space Center (Houston, USA), 2014.09.23—Busy, busy, busy time here in Houston these weeks. It's my last training trip at the Johnson Space Center - in fact, this is my very last week - and there is just so much to do!

Only part of it is properly training - one last emergency simulation here, one last robotics session there, one last day of underwater training for spacewalks in the Neutral Buoyancy Laboratory and one last session on the ground training model of the ARED, our workout machine for weightlessness. And so on.

Another big chunk of the time is spent on Baseline Data Collection (BDC). As I'm writing this, I'm lying on a bed waiting for an MRI scan for the ESA experiment "Cartilage", that looks at the effect of long duration spaceflight on, yes, the cartilage. It' important to let the knee rest before the scan, hence my little 30-min downtime right now that allows me to write this logbook! By the way, I'm also carrying around a cooler for a 48-

hour urine collection and later today I will put on the sensors for the 36-hours core temperature monitoring for another ESA experiment, "Circadian Rhythms". Yes, you remember that one, the bandana days…

Finally, there's those events that really remind you that you'll be flying to ISS very soon. Last week, for example, we had a handover class with Mike Hopking, from Expedition 37/38, who walked with us through the mockups of the Space Station pointing out all those little daily-life-in-space things that it's hard to get from the instructors, just because they haven't lived up there themselves. Where do you charge batteries? Where do you keep camera lenses and how do you manage cameras? Where is the "office space" setup and how is it organized? How about the hygiene corner? The best place to hang your workout clothes to dry?

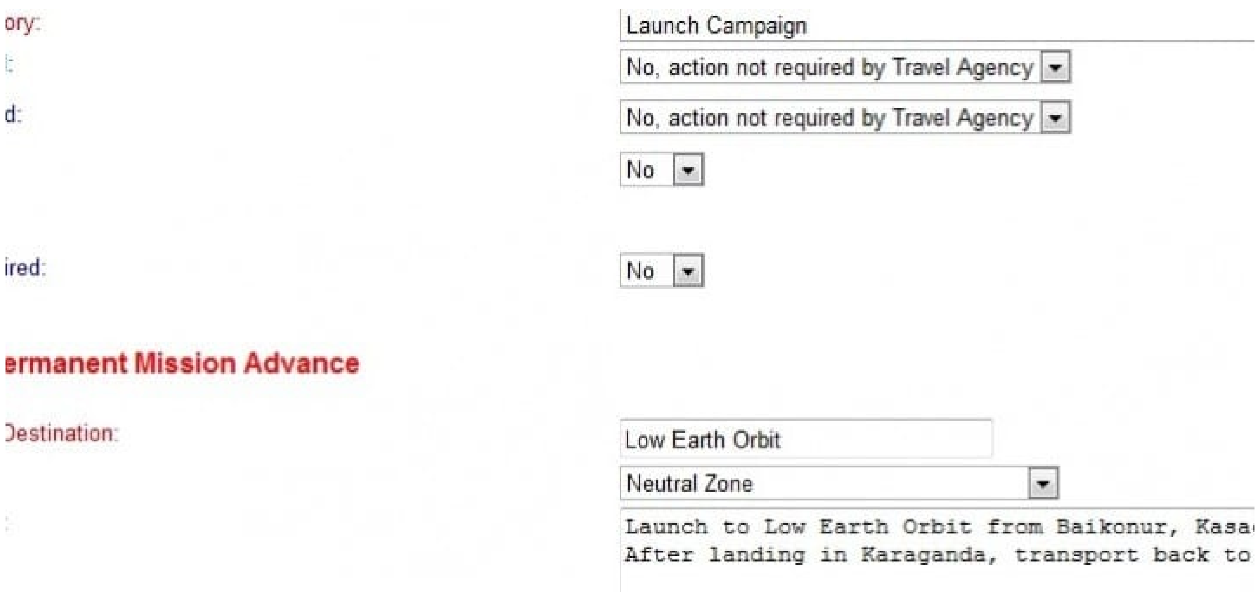
And how about questions like: how are my clothes packed? On what vehicle are they flying up? How will I find them? All that and more is part of the Crew Provisioning briefing. That's how I know that most of my clothes, hygiene and some items I could include myself have just arrived to ISS this morning SpX-4. Hurrà! Somewhat related to that was our briefing on consumables: how are different types of consumable items managed, how is their usage tracked? We got to meet the specialists who will take care of that during our increment. And on a similar topic: what is the stowage and inventory situation onboard? Might not seem very interesting to you, but believe me, it's very interesting to us. Imagine you were to go and live in a house that is overfilled with stuff, that you need to carefully track: you'll probably want to hear a word or two about the current status!

Oh, I'll have to tell you a bit more about yesterday in the next days. I finally had my altitude run in the vacuum chamber. I talked about it here.

The picture is from last July: as you might remember, back then the altitude run had to be aborted at the beginning of pre-breath because of a technical issue. Yesterday we successfully completed the four-hour pre-breath and the vacuum event. I'll tell you more when I'll have the pictures to share! In the meantime, more pictures from last summer are here.

Italian translation of this logbook entry: L-61: Tante domande dell'ultimo *minuto, e fortunatamente molte risposte!, by Paolo Amoroso—AstronautiNEWS.*

L-46



The destination in the documents of the Soyuz TMA-15M flight with Samantha Cristoforetti. Credit: Samantha Cristoforetti

Francoforte (Germania), 2014.10.08—Rushed, rushed, rushed! Every single time I have left my apartment in the last three years to catch a train to the Frankfurt airport to head somewhere in the world for training, my luggage was ready when it was time to leave… and I mean exactly then, not a minute earlier. And every time I have prayed the astronaut guardian angel that I didn't miss anything (or at least anything important) from my ever more inclusive packing checklist.

Why should it have been different today? Maybe because I will see Cologne many times from space (cloud cover permitting) before I come back? Or because I have a one-way ticket to Russia in my pocket - well, on my smartphone? Or because I have a Kazakh visa in my passport?

Or maybe because I have a lot of unique items in my carry-on luggage. Many little mementos that I will fly for family and close friends in my 1,5 kg personal allocation on the Soyuz, for example… not something I want to loose on the way to space (and back) and certainly not on the way to

Moscow.

But I'm also carrying my Soyuz IMAK. No, I don't remember what the acronym stands for, sorry. But "Medical" and "Kit" is probably part of that. The IMAK is like your little travel medicine kit. There is a bigger one for each crewmember on ISS, but we carry a smaller one in the Soyuz - that's a necessary precaution, especially if something went wrong with our six-hour launch-to-docking profile and we had to spend two days in the Soyuz instead before arriving to Station.

And I'm also carrying my personal crew-worn-on kit. That's a number of items that you sort of wear on yourself on your way to orbit: your kneeboard with pens and pencils (and their tethers), velcro strips, your portable stopwatch, your flashlight and yes… the emesis bag. That's a fancy word for that bag that comes in handy if your last meal on Earth just doesn't want to stay in your stomach…

Anyway, here I am now. Boarding almost complete on my last commercial flight: landing in Moscow late tonight, ready to resume training in Star City early tomorrow.

By the way, according to my mission paperwork, I'm not only heading to Low Earth Orbit (yuppie!), but I'm also heading to the Neutral Zone. Take a look! I sure hope those Romulans stay put.

Italian translation of this logbook entry: L-46: Passata l'ultima notte nel mio letto per i prossimi 8 mesi…, by Paolo Amoroso—AstronautiNEWS.

L-43

Samantha Cristoforetti trains to perform an ultrasound at the EAC in Cologne. Credit: ESA

Star City (Moscow, Russia), 2014.10.11—Good to be back in Star City! It's quite a bit cooler here than it was in Europe - and certainly in Houston - but it's very pretty: the trees are showing off all the rich colors of the fall. It's just lovely out here, tucked away from the frenzy of Moscow and its frenetic traffic. And I definitely love that the training facilities are just a few minutes away by bike from the Profilactorium, where we have our accommodations as ESA astronauts.

I've only had two training days, but I've already had a chance to refresh all the skills that I will be tested on in the coming weeks, as part of our final certification: manual rendez-vous, manual docking and manual descent. Anton and I also started training for our complex full-day Soyuz exam (Terry will join us in another week). As per tradition, the first sim is pre-launch operations (what we do on the launch pad before start), ascent, injection into orbit and then… well, that depends on the good heart of our instructor. In our case, we had a leak - we were losing atmosphere into space - and so we had to come back with an emergency descent. That would be a very short flight!

I do want to mention that between training in Houston and returning to Star City I had several days of training at the European Astronaut Center in Cologne. That includes a final refresher of the Columbus systems, but also some additional training in the replacement of a Water-On-Off-Valve. There's 10 of them in the Columbus thermal control system and one has been acting up recently, so it's quite likely that I will be tasked to replace it - a spare is on orbit already.

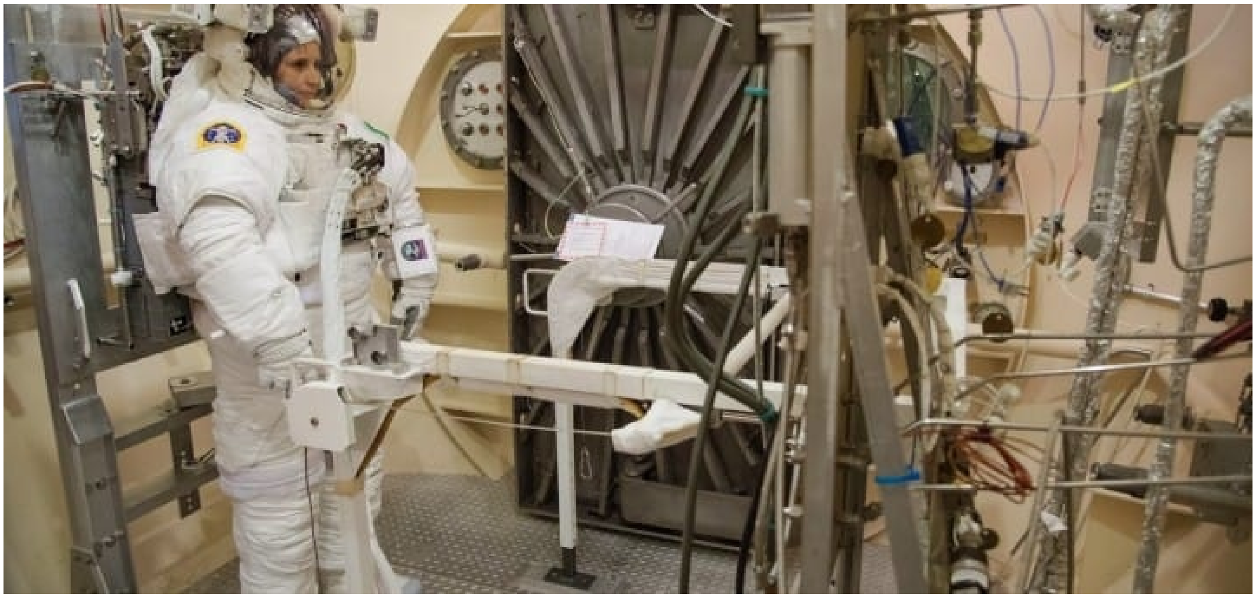
I've also had quite a bit of training on experiments, like the EML (= Electro-Magnetic Levitator. Cool name, ah?). It arrived to ISS last summer on ATV5 and Alex, who's up there right now, has already started to install it, but it looks like he won't have enough time to finish the job and I'll take over. Here's some more info about the EML.

And of course EAC is also where we do Baseline Data Collection (BDC) for a number of human physiology experiments for ESA and ASI (the Italian Space Agency). So for example this week I had to sleep for two nights wearing a special shirt with integrated sensors for the experiment Wearable Monitoring. I talked about here.

An ultrasound of the heart was also part of this BDC, but will not be performed on orbit. For some other experiments, however, we have to do an ultrasound in space as well. For this purpose, we always have an experienced ultrasound operator, who provides remote guidance from the ground, and in training we practice together to make sure that we communicate efficiently. An example of a protocol requiring an ultrasound on orbit is the ASI experiment Drain Brain. In the picture you can see a training session at EAC last August - Manuela is the instructor for this experiment, the remove guider is actually in another room.

Italian translation of this logbook entry: L-43: Farsi un'ecografia… con un bel po' di aiuto!, by Paolo Amoroso—AstronautiNEWS.

L-42



Samantha Cristoforetti in a session in empty room in EMU suit. Credit: NASA

Star City (Moscow, Russia), 2014.10.12—I certainly couldn't miss today's logbook… today is L-42 for Expedition 42!

As I am starting to write this, it's 6 pm in Baikonur, Kazakhstan, where our voyage to space will start in six weeks. At exactly this time, 6 pm, on Nov 23rd, we will wake up after an afternoon nap of 5 hours to start our preparations for launch. Nine final hours on the planet, before the Soyuz engines will light up the night at exactly at 02:59:06 local time (that's 20:59:06 GMT).

But today, let's go back in time a few weeks to my vacuum chamber run in Houston, final event required for spacewalk certification in the NASA EMU suit. Life has been so busy recently, I haven't had time yet to tell you about it.

As you might remember, back in July I did the dry-run, going through all the operations but without actually going to vacuum. I talked about it here.

The next day a technical issue caused us to abort the altitude run, which was postponed to September and moved to a different chamber. This time I was finally able to go to vacuum in the EMU!

That is… at around 2pm, although the day did start at 7:30. As you probably know by now, you can't go to vacuum just like that: the suit will keep you at 4,3 PSI and at that low pressure decompression sickness could be an issue. Therefore, we need to perform a carefully designed pre-breath protocol to get rid of nitrogen which is in solution in our blood.

The way to do that is to breath pure oxygen for a while, which means that we need to replace all the air inside the suit with oxygen. We do that by opening a purge valve, basically a hole in the suit: the regulator keeps supplying oxygen from the tanks into the suit to keep the overpressure up and, after about 12 min, we consider that all air has been replaced by oxygen. Then, we wait… and breath.

In space we actually tend to use the faster In-Suit-Light-Exercise protocol, which we practice in Prep & Post classes, as I have described here.

In the chamber we just breath pure oxygen for four hours, instead. We do have the chance to watch a movie while we wait - I chose Princess Bride, which was a lot of fun! And after the four hours, the chamber pressure was lowered to a very low value - for practical purposes, vacuum.

Compared to the experience in the Orlan vacuum chamber (see here) I got the additional treat of watching a fun vacuum effect: a pot with some water was left on the floor where I could observe it and, sure enough, I could watch the water boil away!

What we didn't do, which is usually done in the nominal chamber, is to drop two very different objects and observe them reach the floor at the same time… well, I guess this will be something to look forward to for next time!

You can find more pictures of the chamber run here.

Italian translation of this logbook entry: L-42: Nella camera a vuoto, dove l'acqua bolle a temperatura ambiente!, by Paolo Amoroso—AstronautiNEWS.

L-40

Samantha Cristoforetti and Anton Shkaplerov before a Soyuz simulation. Credit: GCTC

Star City (Moscow, Russia), 2014.10.14—Today Anton and I spent the morning in the Soyuz sim for a simulation of undocking and reentry. Of course, as usual in the sims, nothing was working properly.

In fact, not only we had to face a fire, but for good measure our instructor Dima threw at us a leak in the nitrogen tanks, which contain high pressure gas that pressurizes our propellant lines. Simply put - no pressure in the nitrogen tanks, no engine burns!

I've talked several times about dealing with a fire in the Sokol, [for example here](#).

Today I would like to talk to you about "separation". As you might now, the Soyuz capsule is made of three components: the orbital module, which is the roughly spherical element on one end, the service module with (most of) the engines on the other end and the bell-shaped descent module in the middle. Only the descent module, as the name suggests, is meant to return to Earth: it has the proper shape and a heat shield to survive atmospheric reentry. Therefore, after the engine burn that slows us down and commits us to get back into Earth atmosphere, we need to separate: as we're safely strapped in our seats in the descent module, the hatch to the orbital module closed, pyrotechnical charges blow the three elements apart. One of those unforgettable moments during the roller coaster ride that is a descent in the Soyuz, or so I am told. You can learn more about that ride in this great video by European Space Agency, ESA

Video: Soyuz undocking, reentry and landing explained (20:44)

But how is separation initiated?

Nominally, by the computer, according to an automatic sequence. After engine cut-off, the relief valve in the orbital module is opened and its atmosphere is vented to space. Also, a pitch maneuver is initiated to assume a safe attitude for separation: that's to make sure that we and the "discarded" modules go our separate ways and don't meet again any time soon. As unkind as it sounds, they're bound for burn-up and we're bound for home! Finally, at the predetermined time, the command to fire the pyrocharges is sent.

If the main computer fails, we can manually assume the proper orientation and give a series of commands to separate manually at the proper time.

What happens, though, if our main engine fails and we have to complete the burn on backup thrusters? Well, that burn takes longer, because the available thrust in that case is a lot smaller. If the main engine failed early on, we'll probably NOT be done with the burn when the predetermined separation time comes. In that case, separation is tied to heating of thermal sensors located on the service module. As some point, as we get into thicker and thicker atmosphere (but we're still above 100 km!) they will reach a certain temperature threshold and that is what will trigger separation.

After that, in most cases, the reentry will be ballistic. Just to provide some stabilization, during the ride the descent module will spin around its axis as 13 degrees per second. Other than that, no active control of the trajectory: in a way, we fall like a rock. Might not sound good, but ballistic reentries have occurred multiple times and the crews were safe and sound at arrival!

In the picture you can see Anton and me before the sim this morning: Terry will join us next week! (Credit: GCTC)

Italian translation of this logbook entry: L-40: Abbiamo cariche pirotecniche sulla Sojuz… sì le abbiamo!, by Paolo Amoroso—AstronautiNEWS.

L-36

Samantha Cristoforetti and Anton Shkaplerov before the manual docking exam for the Soyuz TMA-15M. ESA / S. Corvaja

Star City (Moscow, Russia), 2014.10.18—First exam passed!

Yesterday Anton and I both had a perfect score on our manual docking exam, which was the first of a series of 6 exams we'll have to pass to be qualified for our flight to space on Nov 23rd. The remaining ones are manual descent, manual rendezvous, knowledge of the flight program, Russian segment operations and, finally, the full day complex Soyuz simulation, which will complete the series on October 31st and bring to a close over three years of training.

As you know, it's the second time Terry, Anton and I go through the final exams: the first time was back in May, when we served as backup crew for Reid, Alex and Max, who are now in space. I told you everything about the manual docking exam back then: you can find that story here!

It's certainly nice to have the first exam behind me, but there's also a touch of sadness. Chances of actually flying the Soyuz manually in space are very slim: as you know, the Commander sits in the center seat and is prime for manual flying; and manual docking is anyway only necessary in case of a failure of the computer or the automatic docking system. That means that yesterday might have been my last time manually flying the Soyuz, albeit in the sim, for a long time, or maybe forever…

Anyway, I have a lot to look forward to… certainly not the time to get melancholic! I'm flying to space in 36 days!

Pic: a cheerful start of the exam with Anton, we cracked some jokes with the commission as we picked our envelopes with the exam scenarios (Credit: ESA/S.Corvaja).

More pictures here.

Italian translation of this logbook entry: L-36: Passato il primo esame! Felice, ma con un velo di tristezza , by Paolo Amoroso—AstronautiNEWS.

L-34

Samantha Cristoforetti and Anton Shkaplerov wear the Sokol suit for a simulation. Credit: GCTC

Star City (Moscow, Russia), 2014.10.20—The ground is already white here in Star City and preparation for the remaining exams continues: this week Anton and I will have exams in manual reentry and manual rendezvous.

But today I thought I would write a few words about the Sokol, the pressure suit that we wear in the Soyuz. As you might know, the Sokol is custom made for each crewmember: my suit, for example, is number 422. (Yes, there's 42 in there!).

With the exception of the gloves, the Sokol is one piece and the entire front part (chest and abdomen) can be zipped open: that's in fact how you can put it on. Donning can be tricky when the suit, as it should be, is a tight fit in terms of crouch-to-shoulder length. In this previous logbook you can find a pictorial description of the donning sequence.

And yes, as you might have noticed watching astronauts walk in the

Sokol, it's not really meant for you to stand upright, so it forces you to bend your back forward: that's because it's supposed to feel comfortable when you're laying in your Soyuz seat, with your knees bent towards your chest.

On launch day we don the suit about three hours before launch (yes, after putting on a diaper) in one of the Energia facilities at the cosmodrome. Before leaving the building for the launch pad, we do a first leak check: that's the scene you might have seen on video or photos, when crewmembers take turns lying in a lonely Soyuz seat in the middle of a room, while typically family members, management and some media can observe from behind a glass. Kind of awkward, actually, but that's the way it's done.

A second leak check is performed in the Soyuz during pre-launch operations, right after closing the hatch and turning on the com system, so we can talk to the control bunker. I've talked in this older logbook about the leak checks and the interfaces of the suit to the Soyuz.

Once we put on the gloves for the leak check, we don't remove them anymore until we're on orbit. That's because improper donning of the gloves can introduce a leak, so we don't mess with the gloves any more after the leak check. We do open the helmet, though, and we close it again about 5 minutes before launch.

Once in orbit, we start leak checking the Soyuz, to make sure that we have good seals and we're not loosing atmosphere into space. After the first 15 min of the leak check, if the pressure drop is within acceptable limits, we're allowed to remove the gloves: and believe me, it makes it a lot easier to flip the pages as you work to procedures!

With the new quick flight profile that brings us to docking in six hours, the flight to ISS is very busy and there is no time to get out of the Sokol. It's only after docking that we can change into the more comfortable overalls, that you're probably see astronauts wear when at hatch opening, when they finally entered the Space Station.

As for the Sokol suits: they will stay in the orbital module of the Soyuz until it's time to wear them again for landing. But before stowing them away, there are connected to the ventilation system for a few hours so they can dry!

Italian translation of this logbook entry: L-34: Ecco a voi la tuta Sojuz che indossiamo per andare nello spazio!, by Paolo Amoroso—AstronautiNEWS.

L-32

Samantha Cristoforetti in the centrifuge for a Soyuz manual descent exam. Credit: GCTC

Star City (Moscow, Russia), 2014.10.22—Two more exams passed!

Yesterday Anton and I both passed our manual descent exam in the centrifuge with a perfect score. If you missed it, you can read about how that all works in this logbook from our backup exam period, except that this exam took place in the smaller centrifuge, since the big 18-arm one is in maintenance.

The "little" centrifuge did provide for some excitement: during my second run, it came unexpectedly to a stop after a loud bang. Turns out that some workers in a nearby area of the building accidentally pulled a cable which caused the centrifuge safety response to kick in and initiate an emergency stop. So it wasn't a big deal: I was taken out for some verification and a test run and then we could resume the exam.

In the manual descent exam we pick only one envelope that contains all 10 profiles: 5 for the Commander and 5 for the Flight Engineer. I must say that Anton picked a really good envelope for me: all my dynamic runs (with the spinning centrifuge) were undershoots, meaning that we simulated entering the atmosphere too early. In undershoots, we try to fly a more shallow profile, leading to lower Gs: I never went past 3,6 Gs yesterday, which made it for a really comfortable ride. Well picked, Anton!

And today we passed our rendezvous exam. That's when Anton gets to do the flying and I get to climb into the orbital module to get distance and velocity measurement with a laser range finder. I wrote some more about our rendezvous training here.

Oh, yesterday we also went to Mission Control Moscow for a series of pre-flight briefs by the flight control team about current state of systems and ops. Incidentally, I learned that the more recent ballistic calculations have yielded a later launch time for us. Not a big change, just a couple of minutes. So, our new launch time is on Nov 23rd at 21:01:13 GMT.

Italian translation of this logbook entry: L-32: Passati altri 2 esami, vado nello spazio 2 minuti più tardi, by Paolo Amoroso—AstronautiNEWS.

L-28

Samantha Cristoforetti and Terry Virts in a mockup of the Russian segment of the ISS. Credit: GCTC

Star City (Moscow, Russia), 2014.10.26—Thursday and Friday Terry, Anton and I had our very last training sessions in the Russian segment mockups and in the Soyuz simulator, respectively. We'll only go back in there once more next week for the final exams. Believe it or not, tomorrow we'll start our last week of training.

The Russian segment exam will be first, on Thursday. I've talked about it here, when we took this exam as backup crew in May.

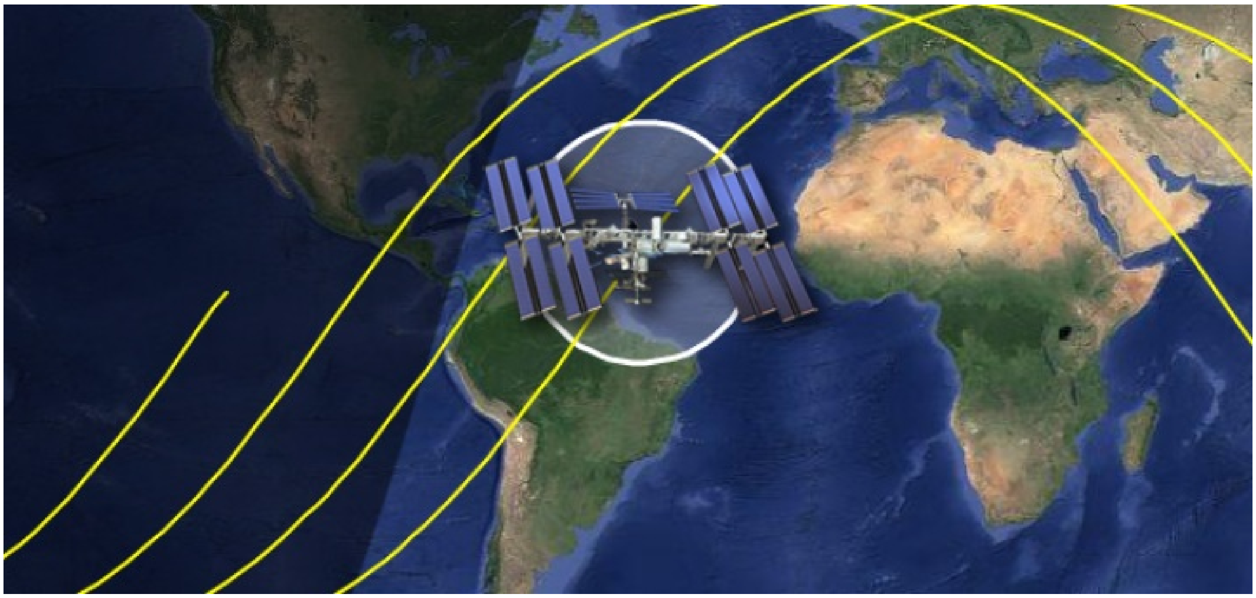
What has changed since then is that Terry and I will report to the commission in the morning, pick the envelope with the scenarios and then… take a break. That's right, we'll only join Anton in the afternoon for 4 hours, instead of participating for the full 8 hours. That's in recognition of the fact that, on Station, it's really the cosmonauts who work in the Russian segments and non-Russians only perform very basic operations. Or, of course, emergency responses.

Basic operations include, for example using the com system, which is a bit more complicated in the Russian segment, because there's more communication options and the crew actually does most of the reconfigurations. When the ISS passes over the Russian ground sites, we need to use the Russian segment VHF transmitters and receivers. Otherwise, we connect the Russian segment audio system to the USOS segment and use its Ku-Band or S-Band channels: voice is then transmitted to Mission Control Moscow via Houston (and viceversa). Since Russian VHF passes are few and not very long, we typically have one Space-To-Ground channel on S-Band dedicated to Russian communication. There's three more channels that can be used for communication with Houston, Munich, Tsukuba and Huntsville. Sometimes one of those channels will be "privatized", for example for our weekly medical conferences with our flight surgeon or for our weekly conferences with our family. "Privatized" really relates to the ground: anybody could potentially listen in on Station from another module. Except that this would be extremely bad space etiquette!

Other basic ops we need to be able to perform on the Russian segment are related to simply being a human: using the toilet, get water, prepare food. Most of the Russian rations are in cans, which only need to be heated. Juices, tea and coffee, as well as soups, are dehydrated instead, so we need to add water. What I'm holding in my hand in the picture is bread: it comes in little cubes that you can put in your mouth whole, so no crumbles! And there are little slots in the heater dedicated to those bread packages, so that you can heat them along with your food cans: certainly not your freshly baked bread from the bakery, but not bad for a space galley!

Italian translation of this logbook entry: L-28: Essere umani nel segmento russo della ISS, by Paolo Amoroso—AstronautiNEWS.

L-25



La ground track della ISS. Credito: ISSTracker

Star City (Moscow, Russia), 2014.10.29—Halfway through our exam week! Today is all dedicated to preparing our upcoming final sims: Russian segment tomorrow and Soyuz on Friday. Can't believe that in little more than two days we'll be completely done!

In the meantime, on Monday Terry, Anton and I passed our Soyuz flight program exam. A specialist came from Mission Control Moscow to grind us about our knowledge of the procedures: what happens when, what do we do if this or that goes wrong and we can not proceed with the nominal plan… stuff like that.

For example, a nominal undocking is always planned on orbit 15 to land in Kazakhstan on orbit 1 of the next day. But if we end up being late for whatever reason, we can still land in Kazakhstan on the two subsequent orbits, number 2 and number 3.

OK, OK… what does that mean? Well, the ISS completes one orbit every 93 minutes (roughly), which means that there are about 15.5 orbits per day. We have a conventional numbering of those orbits, from orbit 1 to orbit 15 (mostly) or 16 (once in a while, to catch up). Since the Earth rotates Eastward beneath the ISS, the ground track of the orbit moves towards the West. So, let's say you passed over your town at 7am; after one orbit, at 8:33, you won't pass over your town any more, because your town has moved to the East in the meantime! How much? Roughly 23 degrees of longitude. You can get an idea from the picture, that I took from ISS-Tracker (www.isstracker.com)

All this to say that, if you want to land in Kazakhstan, you have to plan to descent on orbit 1, 2 or 3: on orbit 4 Kazakhstan will be already too far East and, you guessed it, you would have to wait until orbit 1, 2 or 3 of the next day. Btw, hitting Kazakhstan does not qualify for a precise landing: the country is about as big as Europe! To make sure that there will be a rescue team waiting for us at the landing site, we have to do quite a bit better. There is a lot that plays into it, starting with a very precise timing of the deorbit burn.

The fine tuning is done after atmospheric reentry: the computer flies a trajectory to bring us to the nominal parachute opening point. To be able to calculate the correct control inputs, it has to know the center of mass of the vehicle: that's why loading of return cargo is so important. So important that we had a dedicated lesson about it on Monday.

So, fast forward to next spring: about two weeks before landing we will get a very long radiogram (those are the Russian instructions) with all the details about stowing return cargo, so that the center of mass of the vehicle will be well known!

Italian translation of this logbook entry: L-25: Fare bene i bagagli, e perché le orbite non sono tutte uguali, by Paolo Amoroso—AstronautiNEWS.

L-21

The crew of Soyuz TMA-15 with Samantha Cristoforetti signs the final exam envelope in Star City. Credit: NASA/Stephanie Stoll

Star City (Moscow, Russia), 2014.11.02—Exams finished! Anton, Terry and I completed our very last exam on Friday and then Anton dutifully presided over Russian-style celebrations that started with a formal series of toasts and then migrated to a different location for more partying until late at night. It also happened to be Halloween night and Sasha, our manual docking instructor, even carved a "42" pumpkin for us as a present!

So we are ready to meet our spaceship in Baikonur on Nov 12th, after some rest time here in Star City and the traditional visit to Gagarin's grave on the Red Square next week.

Everything is going according to schedule. Because many have been asking: our departure for ISS is in no way affected by the Antares mishap earlier this week, that led to the loss of the Cygnus resupply vehicle. It's been of course very unfortunate and a reminder that spaceflight is a difficult and risky business, but no life was lost and the cargo can be replaced, thanks to the robust and highly redundant logistics chain of the the Space Station. So, as we like to say on Expedition 42, Don't Panic!

By the way, the mishap also was an opportunity for me to be reminded, once again, of the incredible dedication and professionalism of the human spaceflight teams around the world: when I woke up to the news in Star City, I immediately wondered what the impacts would be. But I only had to look in my inbox: many emails had already arrived and many more would come in throughout the day detailing for us what was lost, what the consequences might be and in many cases even what the recovery plan could look like. It's just been amazing to see all the teams reacting so fast and making sure that they kept us informed and reassured.

One of the people who immediately got in contact with me was my ESA Mission Director, Alex Nitsch, who is the person ultimately responsible for the ESA mission objectives, in particular science operations in Columbus. In this guest post on the Blue Dot blog you can see his take on "the day after".

This might not be obvious but, as you can see from Alex' words, one of the most immediate concerns is to redefine priorities and, accordingly, to rebuild the crew schedule. The crew got a normal weekend off-duty, instead of capturing and berthing Cygnus and, when the working week starts tomorrow, they will be on a new activity timeline. Last-minute rescheduling is not an easy task and I'm sure a lot of people have been working evening and nights: there is always a lot to do onboard, so it's certainly not a matter of finding things to do, but all the constraints and interdependencies have to be considered!

Also, make sure to read Alex' words on "trash and stowage choreography": not the first thing you would have thought of, ah?

As for "my" luggage, there was nothing too personal on Cygnus. The little box I could fill with personal things, like extra socks and some outreach items, is already on ISS: my fellow ESA astronaut Alex even sent a picture of it from orbit to reassure me! And the mementos that have been entrusted to me by friends and family will fly with me on Soyuz. Cygnus did carry clothing for us for the later part of the mission, but there is time to resupply that (and we even have spare clothing on orbit just in case). All my bonus food containers (9 boxes) are also already on orbit and, regarding regular ISS food, there is many months worth of it already stowed on Station!

Picture: signing the envelope with the failures list for our exam (Credit: NASA/Stephanie Stoll). More pictures on Flickr.

Italian translation of this logbook entry: L-21: Esami passati, e lanciamo ancora il 23 novembre!, by Paolo Amoroso—AstronautiNEWS.

L-18

The crew of the Soyuz TMA-15M with Samantha Cristoforetti chooses an exam scenario. Credit: GCTC

Star City (Moscow, Russia), 2014.11.05—As you know, last week Terry, Anton and I passed our final exams. The really big one, of course, is the full day Soyuz exam, where we simulate everything from launch to reentry. I've talked about how it all works when we took the exam as backup crew.

Back then, when it was time to pick one of the five envelopes with the exam scenarios, we happened to pick the most difficult (and physically uncomfortable) scenario, the one with the fire. Since we picked that one, it was not available for the prime crew to pick on the next day.

This time, our backup crew did us the same favor: they had to face the fire scenario in their exam on Thursday, so when we showed up on Friday to pick from the four remaining envelopes, at least we knew it wouldn't be fire for us again!

Our first failure was after insertion: a thermal control system valve failed, so for the rest of the sim we had to control temperature manually by turning on and off the pump that circulates water to the radiators.

Our CO_2 scrubbing system in the orbital module also had a minor failure: the primary fan engine failed and the automatic switchover to the backup engine didn't happen, so we had to take care of that manually as well.

Then we had a computer failure before docking, at a couple of km from Station, and Anton had to fly the approach manually from there. As you might remember, we practice that quite a bit and there's even a separate exam for that.

After the lunch break it was time to simulate undocking and descent. We could assume that the main computer was back online at this point and did a nominal undocking, after which we realized that one of the oxygen tanks, the one located in the descent module, was leaking oxygen into the cabin. That's a dangerous situation, because we don't want the oxygen percentage to go over 40%, which is considered a flammability hazard. So we closed a valve to isolate that tank. Until separation, we anyway have four more oxygen tanks in the service module and after separation, we had enough oxygen in the cabin to breath until landing, so no need to open the valve. (If you don't remember what separation is, I explained it here (Italian translation).

But we did have to reopen the valve after the thermal shield was blown away: that happens at about 5 km altitude, well after parachute opening. Once the thermal shield is gone, a command is sent to open two redundant valves (over which we have no manual control) that allow remaining oxygen in the descent module tank to be vented. It would be quite dangerous to have the tank full of oxygen at landing, so we had to remember to open the manual valve as well, to allow the venting to occur.

In between we had a couple more failure, of course. The main engine failed on us halfway through the deorbit burn and a signal converter in the reentry control system didn't work, leaving us without gyroscope and rate sensor: only solution, switch to ballistic reentry. Not even the "prime" ballistic reentry system, but a backup one, that makes use of a its own backup rate sensor.

The Soyuz does have a lot of options to down-mode reentry following all kinds of failures: one way or another, it brings you home!

Photo credit: GCTC

Italian translation of this logbook entry: [L-18: Ripensando agli esami Sojuz della settimana scorsa](), by Paolo Amoroso—AstronautiNEWS.

L-1

An Orthodox priest blesses the Soyuz TMA-15M rocket in Baikonur. Credit: GCTC

Baikonur (Kazakistan), 2014.11.22—Well, this is likely my last countdown logbook (or maybe the second last). Over two weeks ago I told you about our final exams in Star City. In the meantime, the countdown is almost down to zero and it will be soon time to start counting up… from orbit!

Just to give you a few (mainly visual) impressions from the past few weeks:

…back in Moscow we participated in the traditional visit to the Gagarin's tomb on the Red Square, after a press conference and a visit to Yuri Gagarin's office in Star City, where we signed "the" book

On the Red Square a lays flowers on the tomb of Gagarin. Credit: GCTC

…Tuesday last week, after a traditional "breakfast" where everybody gathers around a table full of food, but nobody eats, we boarded a plane to Baikonur to start our quarantine

Departing for Baikonur. Credit: GCTC

…on the following day, we were up early to drive to the Cosmodrome to meet our spaceship: we were in the descent module both in flight suits and in the Sokol, practicing descending down from the orbital module; we did com checks; we reviewed where the survival equipment is stowed; we familiarize ourselves with our space vehicle

In the Soyuz TMA-15M during a test in Baikonur. Credit: GCTC

…we planted trees (Terry and I now have our own tree on the cosmonaut alley)

The new tree in the avenue of the cosmonauts in Baikonur. Credit: NASA

…we trained our body and our vestibular system on the tilt table and the rotating chair

> Rotating chair and tilt table during quarantine. Trying to get the body used to weightlessness! [#Futura42](#) [pic.twitter.com/YDxpk08YRN](#)
>
> — Sam Cristoforetti (@AstroSamantha) [November 22, 2014](#)

…we signed thousands of photographs

> And signing all kinds of things is part of the pre-launch preparation too Ѓ [#Futura42](#) [pic.twitter.com/6c13YiLGty](#)
>
> — Sam Cristoforetti (@AstroSamantha) [November 22, 2014](#)

…we went to meet our spaceship one more time; this time it was already in its shroud and after we left, it was transferred to the rocket assembly building to be mated to the rocket

The Soyuz TMA-15M in the protective shield. Credit: Energy

…we visited the cosmodrome museum and even the original little rooms of Gagarin and Korolyov

> Crew selfie in Yuri Gagarin's little bedroom at the #Baikonur cosmodrome yesterday with @AstroTerry & @AntonAstrey. pic.twitter.com/7rDaQAkRmr
>
> — Sam Cristoforetti (@AstroSamantha) November 20, 2014

…our rocket was rolled out to the pad

The rocket with the Soyuz TMA-15M is transported to the launch pad in Baikonur. Credit: GCTC

…we had a meeting with representatives of the search and rescue teams, hundreds of people and dozens of assets deployed along the ground track of our ascent all the way to the Pacific to rescue us in case of need; and also ready to rescue us back in Kazakhstan should we need to do an emergency landing in the following few orbits.

…we had a meeting with the ballistic group, giving us the latest information from their side.

To spend a few more words on that: if you're counting down to the second, you might want to know that start has been moved by one second to 00:01:14 Moscow time (that's 21:01:14 GMT, but we use Moscow local time on the Soyuz), with a maximum acceptable delay of 10 seconds. The rocket will burn for 528 seconds, thus inserting us into a slightly elliptical orbit with an average altitude of 220km. The phase angle will be about 25°, which means that we will be 25° behind the Station. Since we'll be also about 200km lower, we will be faster and catching up (that's orbital mechanics for you). 25° is a bit less than the ideal phase angle of 30°, so we will have to raise our orbit quite a bit: we don't want to catch up with Station too fast!

About 45 min after launch and then again about 45 min later we will give engine burns of over 30m/s each that will raise our orbit and, that's the magic of orbital mechanics, also slow us down closer to the speed of ISS.

Later we'll have two more small correction burns to completely fix our orbit and then, about 3 hours and 45 min from launch we'll start the rendezvous sequence with the Station, progressively raising our orbit to Station altitude and diminishing our relative speed (at docking, it will be only about 8 cm/sec!). At about the same time the Station will maneuver to turn around 180° and put the Russian segment in the direction in flight: in the very last portion of rendezvous, we will actually fly ahead of the Station, so in the final approach we'll be flying in front of it.

Docking is planned for 5:53 Moscow time (02:53 GMT) when we'll be about to cross the equator off the Western coast of South America. But probably we'll dock a bit early: once we're aligned and station keeping at 150m from our docking port, most likely Mission Control Moscow will give us permission to give the final approach command a bit earlier.

But the way, due to maintenance work at the usual Pad 1, we will launch from Pad 31. Since we can not go to the rollout as prime crew, I'll see it for the first time on launch night…ehm, tomorrow!

Here's a picture of the traditional blessing of the rocket this morning.

Italian translation of this logbook entry: L-1: Ancora una notte e saremo nello spazio!, by Paolo Amoroso—AstronautiNEWS.

L-0: Launchday Logbook

The Soyuz TMA-15M rocket on the 31/6 ramp of Baikonur. Credit: Oleg Kononenko

Baikonur (Kazakistan), 2014.11.23—Well, I told you that it might not be my last pre-launch logbook yesterday. I woke up a bit earlier from the planned 5-hour nap and there's no point in trying to go back to sleep, so here I am, sharing a few departing thought. The doctors will show up in about 40 min to start a series of hygiene operations: before going to space I'll be as clean as I'll ever be, outside and inside (if you get the message, I'm not going into any details here).

I've picked up my computer and come back to bed. My last time in a bed for many months. Who knows if my body will miss it or will like sleeping in weightlessness. The nap has been weird: part of my brain was dreaming, part of it was awake watching myself dream. But that's how the past few days have been: part of me was living all the events, meetings, traditions of the past days, and part of me was almost watching a movie unfolding.

Now almost everything is done. My bags are neatly packed and will be taken to their final destination by my family, the backup crew and the ever helpful ESA support personnel. Hopefully, it's all properly organized: part of the luggage will go into my landing bags, one for the nominal landing site and one for the ballistic site. Part will go home to Cologne, part will eventually find its way to Houston for my return.

Email is set up with out-ouf-office replies: kind of cool to be able to write "Sorry, I'm off the planet for a while".

Many friends have made it all the way to Baikonur (you guys rock!): we've had a chance to spend some time together, albeit in the somewhat awkward condition of having to talk through a glass wall. I could have direct contact with my closer family, who have been medically monitored. All will be waving us goodbye in a few hours as we exit the building to board the buses to the cosmodrome.

In a day like this (well, will there ever be another day like this?) I feel that the most important thing is to say thank you: I've had many occasions to thank publicly the organizations that have made this spaceflight possible for me. But now I would like to say a more personal thanks to my family, my friends, my teachers, my colleagues, all the many people who have helped me arrive to this day, by supporting me or by challenging me, by teaching me something or simply by being there for me. I go to space with all of myself, with everything that I am and I have experience, and I certainly take with me every person I have met.

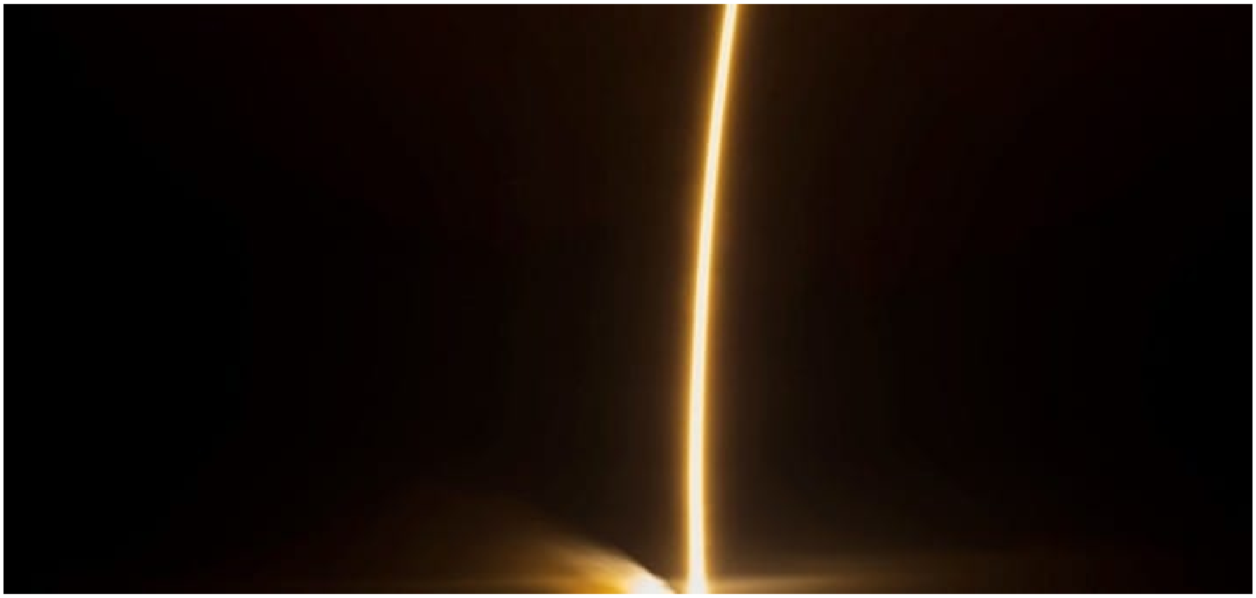
I'd like to share a picture that our backup, Oleg Kononenko, took on Friday as our rocket was raised on the launchpad. I can almost see my seat up there at the top!

Don't forget to play our #LaunchPadPlaylist along with us tonight around 30-40 min before launch.

All the best, and talk to you from space!

Italian translation of this logbook entry: L-0: Qualche pensiero e ringraziamento prima della partenza!, by Paolo Amoroso—AstronautiNEWS.

L+1



The launch of the Soyuz TMA-15M in Baikonur. Credit: NASA

ISS Space Outpost. Earth Orbit—Mission Day 1 (2014.11.24)—Wow, wow, wow! It's 22:00 here on the International Space Station (we're on GMT time), I'm approaching the end of my first day in space and I cannot even begin to describe the experience of the past 30 hours or so. Really, I don't know.

Saying good bye to my family, suiting up for launch, getting to the launch pad, riding up the elevator, strapping in… and then the launch, this wild ride to orbit and then an abrupt engine cutoff and feeling my body wanting to float off my seat. And the first glimpses of Earth: my first sunrise, the stars. My first sight of the ISS as we approached (more to that later) and then floating through the hatch into the warm embraces of Sasha, Elena and Butch.

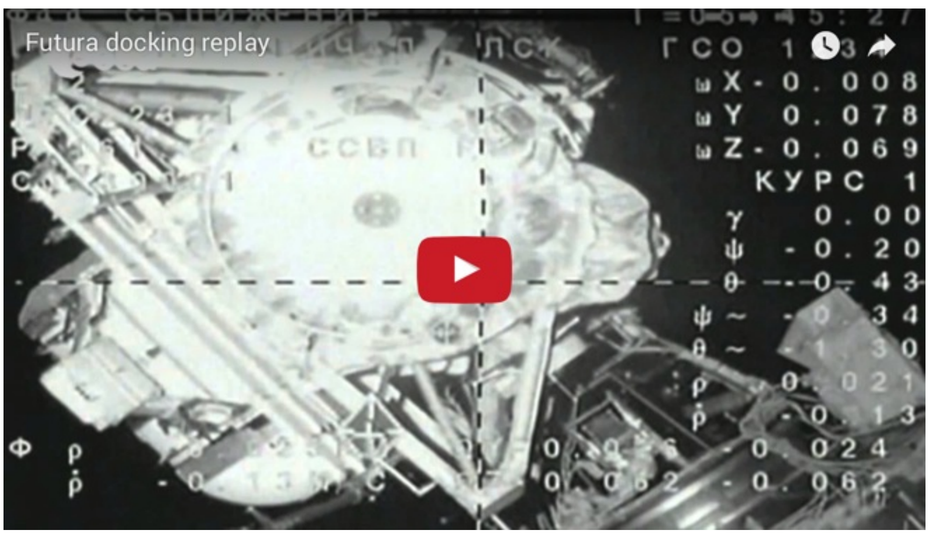
The launch of the Soyuz TMA-15M in Baikonur. Credit: NASA

The first clumsy attempts at “flying”, having our first meal, Butch giving us the toilet brief, Terry calling me to watch a sunrise from the Cupola… and so many more impressions. It will take my brain days to process it all and I promise I will share as much as I can!

For now, I will tell you of one moment, which was so fortunate and unexpected. You know, when you fly to the Space Station in the Soyuz, unless you are the Commander sitting in the center seat, you can only see your destination from far away in the black and white camera view (the same image that is transmitted to Mission Control and usually shown during media coverage of docking). As a left-or right seater, you only have a side view and there’s no way to see the Station until you’re really close and parts of it start coming in your field of you. Before the flight, previous Soyuz fliers had reminded me to start looking for the Space Station in the side window in the last part of the approach and so I did: but I wasn’t prepared in the least for what I saw when we were at about

30-40 meters.

I had released my shoulder straps quite a bit at that point, so I was floating over my seat. As I turned to look outside, at first I looked back and saw one of our Soyuz solar panels, which I had seen before of course. Then my eyes caught something in the peripheral view. And as I slowly turned my gaze and when I realized what I was seeing, I was overcome by pure amazement and joy: the Space Station was there, but not just any view. The huge solar panels were flooded in a blaze of orange light, vivid, warm almost alien. I couldn't help exclaiming something aloud, which you can probably hear in the recordings of our docking, since at that point we were "hot mic" with Mission Control. Anton reminded me of that and so I tried to contain my amazement and return to the docking monitoring. When I peaked again later, the orange glow was gone.



Video: [Futura docking replay]() (8:37)

Butch told me later that he had heard my amazement on com when "the Station had turned orange." I didn't know, but apparently there's only a few seconds during day-night transition that the Station is lit by that amazing orange glow. And it happened to be exactly when I peaked outside! I feel very fortunate that I had such a unique first glimpse of our human outpost in space: such a great welcome!

Which was only trumped, by the way, by the amazing welcome our veteran crewmates Sasha, Elena and Butch prepared for us!

Immediately after our arrival they took us to the Service Module to say hello to our friends and relatives in Baikonur and as soon as we have a few minutes break in the cm coverage they started to “ set the table” with all the food they had already warmed for us!

Italian translation of this logbook entry: L+1: Wow wow wow… Sto scrivendo dallo spazio!, by Paolo Amoroso—AstronautiNEWS.

L+2

Samantha Cristoforetti in the ISS Destiny laboratory. Credit: NASA

ISS Space Outpost. Earth Orbit—Mission Day 2 (2014.11.25)—Here I am, wrapping up my first “regular” day on the International Space Station! In a way, it feels like I arrived here a long time ago: when you discover new things every minute and your mind is absorbing so many experiences and information, it feels like time expands. It’ s hard to believe that we only arrived yesterday morning, launch feels already so far away.

On the other hand, every time I bump into something because of my beginner’s flying skills, or every time I need to ask Butch a question (which is every few minutes), I am reminded that I have only just arrived and I have so much to learn!

Butch, of course, is our veteran crewmember on the non-Russian side of the Station, he’s been up here since September. And, thankfully, he is the paragon of patience. He made it clear from the start that the number 1 rule is: don’t hesitate to ask a question, even if you know you’re asking it for the 15th time!

I’m thankful that I have had the luxury of a rather light schedule for this first day. Mostly, I have done preparation work for upcoming experiments. Later this week Sasha, Elena and I will install the experiment Plasma Kristall 4 (PK4) in Columbus, and for that I had to do some cleanup and stowage reconfiguration. In itself an easy task, but quite challenging when you just got to space and you’re not yet in perfect control of your body, let alone of five big bags you have to somehow manage while accessing a particular locker. Finding a particular item in a bag, then, can also be challenging, if that bag is also full of other small items you’re not interested in, but who simply refuse to stay inside.

In addition to the PK4-related tasks, I was also scheduled to do preparation work for the Italian Space Agency Experiment “ Blind & Imagined”: I gathered all the necessary equipment and temp-stowed in the Japanese Laboratory JEM, where the experiment will take place, and I routed some cables.

I also got to do some self-study (we call it onboard training) to operate the 3D printer demonstrator that is onboard; since this study session was on my schedule, I expect I will get to work with the 3D printer soon!

As for flying: it’s a lot of fun, but not so easy! Especially the US Lab (Destiny) is challenging, because the rack fronts are full of equipments that a clumsy flyer like me could potentially damage.

But hey, this evening I already felt a lot more confident than this morning, so hopefully soon I’ll be a proficient flyer. One thing it’s sure: it’s a great feeling!

Italian translation of this logbook entry: L+2: Volo per principianti, by Paolo Amoroso—AstronautiNEWS.

L+3

Samantha Cristoforetti eats asparagus rehydrated in Node 1. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 3 (2014.11.26)—(Written November 27th) With some delay, a few words about my day yesterday on humanity's outpost in space!

Most of my day's activities were dedicated to the Italian Space Agency experiment "Blind and Imagined".

I'll confess, not the easiest experimental setup, especially for the ISS visitor with the least space time ever (that would be me, at least for a few more days – hey, you have to find your records where you can!).

"Blind and Imagined" takes place in the Japanese Laboratory JEM and requires setting up a set of four cameras called Elite, which monitor a specific volume in the module. Inside that volume, the subject performs a series of movements and the motion in three dimensions is tracked precisely by the Elite cameras, thanks to a series of reflective markers attached to the subject's body: its' basically little spheres, the size of a marble, with special optical properties. They clip on an adhesive strip and can therefore be applied on the skin: I had to put a number on them on the right side of my body, from the ankle to the forehead, including quite a few on the hand for the second part of the protocol, in which I had to imagine throwing a ball to a target with different force levels. In the first one, instead, I had to reach for a target in front of me, bending at the hips and the ankles, sometime with open eyes, sometimes with closed eyes.

The experiment is aimed at studying sensory-motion adaptation in space. How does your brain adapt its strategy of controlling movement and balance in this very alien condition of weightlessness?

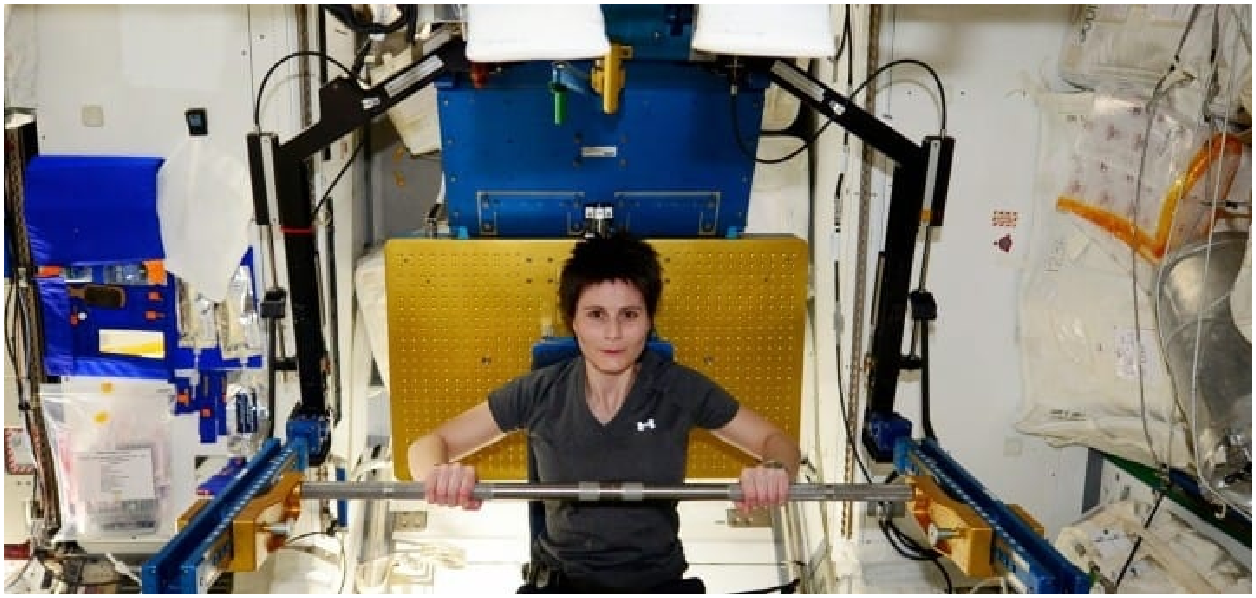
Any understanding we gain into the functioning of the brain could help us in time in treating people with neurological disorders or injuries.

Well, the "Blind and Imagined" investigators will draw their rigorous conclusions from the data, but I certainly have fun just observing the tricks my brain plays on me. For example, when I find myself moving along, say, the ceiling, my brain thinks that that's the floor, so when I have to turn into a side module I'm constantly tempted to make a wrong turn because my brain expects it to be on the opposite side. Or sometimes I have to make a conscious effort for a second or two to figure out where I am: is it the floor, the ceiling, a wall? I'm sure it will all become quicker with time, or at least Butch says so.

Also, yesterday I had some great rehydrated asparagus, so far my favorite rehydrated veggie from Self-Service Restaurant Node 1!

Italian translation of this logbook entry: L+3: Gli scherzi che vi gioca il cervello a zero-g, by Paolo Amoroso—AstronautiNEWS.

L+4



Samantha Cristoforetti trains with ARED in the Tranquility module. Credit: NASA

ISS Space Outpost. Earth Orbit—Mission Day 4 (2014.11.27)—Yesterday Terry, Butch and I had a day off to celebrate the US holiday Thanksgiving. I like the thought of having a day specifically dedicated to gratitude and the things we're thankful for: from my side, I was really happy about a day off!

I did have to do some work, mainly in support of our Russian colleagues Sasha and Elena working in Columbus on the assembly of the experiment Plasma Kristall 4, but most of the day I could use to get my space life a bit more organized and to get started on using the exercise machines.

My biggest achievement has been organizing my little sleeping station: it's about the size of an old telephone booth and it contains of course my sleeping bag, which I typically roll up and stow out of the way during the day.

My two personal laptop computers also live in my sleeping station and a footrail is convenient located on the floor to provide anchoring while working on the laptops. One is called SSC and I can use it to look at the schedule, to use my onboard email, to read procedures, to download pictures and videos to the ground, to search the inventory management system and much more – it's connected to the onboard network, so I can even access it from my iPad (which also lives in my sleeping station).

The second computer is completely disconnected from the onboard network and can be used to remotely login to an image on a server in Houston: it's our way of connecting to the internet.

I also keep in my sleeping station the clothes I am currently using, a few hygiene items like deodorant, handcream and chapstick, a water bag with straw that I can refill at the water dispenser in the nearby module, my crew notebook.

How do I secure all this? Well, like everywhere else on Station: with Velcro, bungees and clips (with Velcro on them). Luckily, many people have lived here before me (the last one, my fellow Shenanigan Alex!), so all that is needed for a 5-star space accommodation is already set up.

Ah, my camera with flash is in here too. For internal photos, we try to use "our own" camera as much as possible: it makes it easier to track photos and download them. It's not only about taking pictures of our life and work onboard: very often the ground will ask that we photo-document a piece of equipment or an activity.

As I said, I also had my first workout yesterday, first of CEVIS, our ergometer, and then on ARED, the Advanced Resistive Exercise Devise, on which we can perform a number of exercises, from squats to bench presses. Butch gave us a great briefing about the peculiarities of these machines, especially ARED: if we don't treat it right, it will break on us, which we really don't want. We need exercise to preserve our muscles and bones!

The picture was taken by Butch from the Cupola. One of this days I will take a camera and show you the view from the other side. Certainly the best view from an exercise machine, on and off the planet!

Italian translation of this logbook entry: [L+4: Dormire in una cabina telefonica](), by Paolo Amoroso—AstronautiNEWS.

L+5

The SpinSat satellite before release with the JEM robotic arm. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 5 (2014.11.28)—Yesterday Terry and I had one more day (I assume the last one) with a lighter work schedule that included time for orientation and for handover with Butch. Still, I got to do a lot of different activities both on the payload side (that's a fancy name for science) and on the systems side (that's another fancy name for maintenance work on the Space Station itself).

On the science side, I performed an ultrasound session for the Italian Space Agency experiment Drain Brain. The specific hardware of this experiment was lost on the Orbital mishap, but a replacement hardware will be on its way soon on the SpX-5 cargo mission. In the meantime, we could get the science started with the standard ultrasound equipment of the Space Station.

Of course, I'm not able to do an ultrasound on my own: a private audio channel was set up with the Principal Investigator on the ground, who provided remote guidance based on real-time data from the ultrasound machine. He could also see a live video downlink of me performing the operations. Things went pretty smoothly, especially thanks to the fact that in the morning I had assisted Butch in performing his ultrasound (a more complex one, requiring two people) for the experiment Cardio-Ox. Butch had introduced me to a great trick of space ultrasound: no need to use a messy gel on the ultrasound probe, you can just use water!

Yesterday I also got to do my first systems maintenance, replacing one of the many components of our Water Recovery System: that's the equipment that produces our potable water from (already pre-processed) urine and from the condensate (the water recovered from the cabin air, for example from our sweat or from our breath). I'm also happy to report that I had a chance to work in our European cargo vehicle, the ATV5. Nothing very complex, in truth: I got to introduce some gas from the ATV tanks into the Station atmosphere, increasing our onboard pressure by 7 mm of mercury.

I was also scheduled to do a visual inspection of our T2 treadmill, in particular of the elements that make up its vibration isolation system. As you can imagine, we don't want to impart big loads on the structure of the Station when we run: on the one hand, to preserve the lifetime of the ISS; on the other hand, it would be hard to make microgravity science if the Station was shaking while we are running! Good news, our vibration isolation system is in great shape! Still, some activities require that there be no running on T2. Just yesterday, we had quite a few hours on "No T2" on the crew constraints band of our electronic schedule. That's because JAXA was moving the Japanese robotic arm for the deployment of the Spinsat satellite, which happened successfully.

In the picture, you can see part of the SpinSat when it was still on the slide table of the Japanese airlock (looks like a metal sphere). At that time, the Japanese robotic arm was about to move in to grab the satellite with its deployer and we took a peak from the JEM windows.

Italian translation of this logbook entry: L+5: I trucchi dell'ecografia spaziale, by Paolo Amoroso—AstronautiNEWS.

L+6, L+7

Samantha Cristoforetti vacuumed in her apartment in Node 2. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 6 and 7 (2014.11.29-30)—First weekend in space is over, time to get ready for our first full week of work on the Space Station. But how has it been up here in these last two days?

Well, for one thing, more private, since the onboard cameras are not set to download live video on the weekend. Also, very quiet, to the point of feeling strange: calls from the ground are very rare and typically contain only brief communications, for example notifying a crewmember that a Space-To-Ground channel has been privatized for a private conference with the flight surgeon or with the family. I had both this weekend, but only because I have recently arrived on Station and facetime with the flight surgeon is scheduled more often.

In the future, except in case of medical issues, we will only talk once a week on a workday. The private family conference, on the other hand, is a weekly event that is typically on the weekend. With the webcam, you can show your family the Space Station or even a view from the Cupola!

Saturday is also cleaning day. Our ISS Commander, Butch, assigned us to the different non-Russian modules: he took care of Node 3 and PMM. Terry cleaned Node 1, Airlock and Lab and I devoted my labor to Node 2, Columbus and JEM. Granted, I had the easiest task, since the toughest modules to clean are certainly Node 3 (where we have the toilet and the exercise equipment) and Node 1 (where we eat). But we'll rotate in the next weeks, so we'll all get our share of fun.

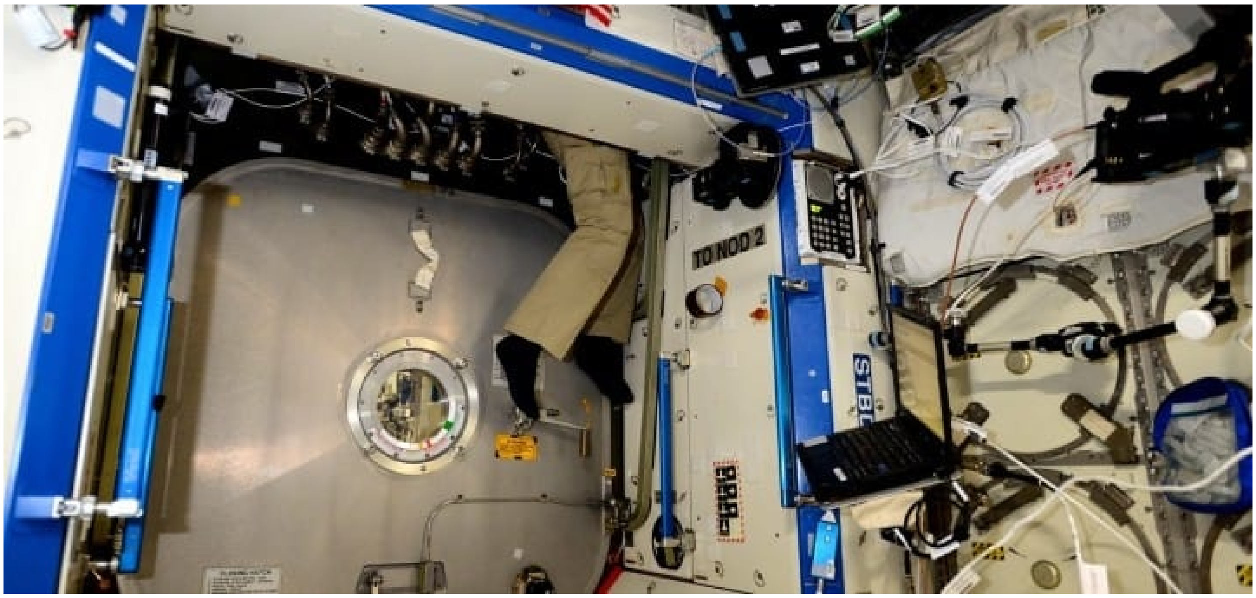
To clean we use the vacuum cleaner on all the ventilation grids: especially the return grids get pretty dirty, because all the little debris that floats in the cabin eventually gets taken by the airflow to a return grid or another. It's very important to keep the grids clean to ensure proper airflow throughout the Station. Carbon dioxide scrubbing and oxygen introduction only occur in certain places and proper circulation ensures that we have everywhere a good atmosphere to breath.

After vacuum cleaning, we use disinfectant wipes to clean the surfaces of most frequent use: the handrails, the handheld microphones, the computers. And we take the opportunity for a general check, for example ensuring that no ventilation outlets or inlets are blocked by something stowed too close in front of them.

In the picture, I'm vacuum cleaning our crew quarters in Node 2. That is my own, in the deck location. Butch and Terry live in the port and starboard locations and Sasha lives on the ceiling crew quarter. Anton and Elena have their sleeping stations in the Russian Service Module.

Italian translation of this logbook entry: L+6, L+7: Il primo week end nello spazio, by Paolo Amoroso—AstronautiNEWS.

L+8, L+9



Samantha Cristoforetti accesses a connector in the Destiny laboratory. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 8 and 9 (2014.12.01-02)—My second week on ISS has started and it’s time to start collecting samples for a couple of human physiology experiments: Microbiome and salivary markers.

This morning, as I woke up and opened up my schedule on the laptop (conveniently located 10 cm from my nose in my sleeping unit), I have found a friendly reminder inserted right after wake-up time: no eating, drinking of brushing teeth before collecting the saliva samples!

I had already had a short activity yesterday: to go and gather all the necessary equipment, which I had then stowed in my crew quarters, so I had everything ready to take three samples, a collection that I will repeat daily for the next seven days.

A second short activity on my timeline contained the location where I had to store the saliva samples. Simply put, they go into the freezer within 30 minutes from collection, but where exactly? We have three MELFI freezers onboard, each has four drawers, each drawer has four sections and each section has multiple stowage boxes. Since it's a freezer and it takes a lot of energy to keep it cooled, whenever we open the door we don't want it open for longer than 60 seconds. It's worth taking the time to be really sure of the location the samples go to. That's especially crucial for retrieval, of course, when you need to quickly locate what you need to transfer out of MELFI and likely into a cold bag for transportation back to Earth.

Tomorrow morning, by the way, I will also have a blood draw. Since it's my first one, one of our medical trainers will be on console in Houston, ready to assist and answer any questions.

My physical trainers were also on the ground ready to give feedback today for my supervised exercise session on the ARED: that's when you setup a camera and the trainers can watch real-time your exercise form and give you suggestions.

The proprioception in space is quite different and you might be doing your exercises with poor form without realizing it, leading to reduced effectiveness or even injury.

ARED sure takes some getting used to: for example, when you do a squat, not only you move the bar "up", but you actually push "down" the platform that your feet are standing on. And the entire machine is free to move on three axes (that's how avoid inputting loads onto structure): the first couple of times I did squats I had the feeling, after every repetition, that the machine was forcing me to fall forward.

Anyway, however hard your workout was, when you get to benchpress or crunches and you're laying with your back to the platform, one thing is sure: you have the best view a gym every had. You're facing straight down into the Cupola and through the windows onto the planet!

Among the many other activities of the past two days, I had one that was particularly fun: I had to remove a connector in a hard-to-access location on the Lab endcone and for that I had to lower the Lab forward hatch.

That’s quite a big deal, by the way: we always keep the hatches open, for safety reasons. In this case, even if I did not latch the hatch, but only lowered it, we had to make sure that everybody was in the Lab or aft of it, meaning that nobody was cut off from our escape vehicle (our Soyuz) in the unlikely event that for some reason the hatch got stuck in the lowered position.

In the picture you can see the hatch lowered, as I fly up to reach the connector. Also, on the right side, you can see one of the MELFI freezers with its four circular drawers.

Italian translation of this logbook entry: L+8, L+9: Iniziati gli allenamenti per mantenersi in forma spaziale, by Paolo Amoroso—AstronautiNEWS.

L+10

The SpinSat satellite in the JEM airlock before release. Credit: ESA/NASA

Dal Diario di bordo di Samantha Cristoforetti (nota scritta il 2014.12.03):

ISS Space Outpost. Earth Orbit—Mission Day 10 (2014.12.03)—First of all, I’m happy to report that I have successfully provided five tubes of blood to science this morning, I have dutifully centrifuged them and put them in the freezer, in support of the experiments Salivary Markers and Microbiome.

Terry was assigned to support me here onboard and our trainer Penny was ready to answer our questions on Space-To-Ground from Houston at 1 am local time! The only thing I will add on the topic is that, well, it’s good to have two arms!

With blood and salive samples safely in the MELFI freezer, I started my day by repressurizing the JEM airlock: as you may recall, we deployed a small satellite using the Japanese robotic arm last week and the satellite had been transferred outside via the Japanese airlock, which had remained at vacuum ever since.

Then I began a series of cleaning, inspection and minor maintenance activities on the Biolab rack in Columbus, the research facility dedicated to biology and live science. The purpose was to make sure Biolab is fully ready to support upcoming experiments. The Biolab activities took a bit less time than planned, so I was free to start the prepacking activity for the soon-to-arrive Dragon cargo vehicle: we will be very busy during the time in which Dragon will be docked, so it's necessary to have the return cargo already packed and ready to be stowed quickly when the time comes.

I also got to take a sample out of the 3-D printer demonstrator which is located in the glovebox. The facility runs automatically, but a couple of times per day Butch or I will access the 3-D printer tray and remove the sample that has been printed. All these samples will return to Earth and will be compared to analogous samples printed by the same 3-D printer model on the ground, to determine the influence of weightlessness.

I also performed a couple of refill cycles of the urine tank in our Urine Processing Assembly from the urine containers from the Russian toilet. Probably not a dinner table topic, but if you're curious about how we manage urine, and ultimately water, stay tuned…likely a topic of a future logbook!

By the way, for no reason whatsoever I have just tried to hold my arms along my body, in the natural position in which they have been all my life while standing: it's amazing how much effort it actually takes to keep my weightless arms in that position. It's not at all the natural position they want to be in.

The other thing I noticed when exercising is that my hands get a lot more tired from holding the bar, for example during a deadlift. I can't quite explain it, but Terry suggested it might be due to the fact that I use my hands all day to translate along handrails. Could be…

Anyway, time to sleep for me now. I have been sleeping like a baby ever since I got here: I let myself float in my little sleeping cabin and have no pressure on my body at all. I think this is how I was always meant to sleep!

(In the picture you can see the Japanese airlock last week, when the outside door was open the slide table extended outside to present the satellite to the robotic arm).

Italian translation of this logbook entry: L+10: Donare sangue alla scienza, by Paolo Amoroso—AstronautiNEWS.

L+11

Samantha Cristoforetti replenishes the waste water from the Node 3 toilet. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 11 (2014.12.04)—Yesterday was quite an epic day on ISS, thanks to Butch and Terry: one day earlier than originally planned, they successfully completed a multi-day, extremely complex maintenance task on one of our two CDRAs – the Carbon Dioxide Removal Assembly.

With plenty of support from the ground specialists and great concentration and attention to detail from their side, they got our Node 3 CDRA back in shape so that we're back to full redundancy.

CDRA is a vital component for our survival on ISS: on spaceship Earth plants take care of "scrubbing" the CO_2 we exhale from our atmosphere – on spaceship ISS we need the CDRA.

From my side, I got to do the first run of the ESA experiment Skin-B: with three different instruments, I took a series of measurement on a specific location on my forearm (the same we used for pre-flight data collection).

First I used an instrument call Tewameter, which measures the evaporation of water from the skin surface: this is an indicator of water loss across the skin, which in turn indicates how good the barrier function of the skin is.

A second instrument, called corneometer, measures the moisture level. And finally, by using a small handheld UV camera I could take a very detailed picture of the surface of my skin.

While science is the purpose of use being up here, we need of course to take care of our ship and make sure we can live up there as human beings. As you can imagine, a well functioning toilet is certainly part of that. Yesterday for the first time I got to access the bowels of our beloved space toilet for a relatively simple routine operation: refilling the flush water tank.

Of course, we don't really have a toilet bowl to flush, but at the beginning of every use, when we turn on the fan to create the necessary suction, a certain quantity of a pre-treat chemical, diluted with some water from the flush water tank, goes through the piping – it takes a few seconds, a light goes out and the toilet is ready for "Number 1".

Once in a while, that flush water needs refilling. Normally, we only need to reconfigure the valves to let water flow into the tanks, but this has been shown to cause some overpressure which has triggered fault lights in the past. Therefore we now have a temporary setup to provide pressure relief during refill, as you can see in the picture.

Something people often wonder about is: how it smells on the Space Station. I was actually very curious myself, because I had heard conflicting reports. To be honest, I can't recognize any particular odor – it seems pretty neutral to me, the filters do a great job. Only our Soyuz has a distinct smell, not sure of what, but it's very dear to me: whenever I float in there, it brings me instantly back to launch day!

Now, if you're working close to a solid waste container, like I was yesterday for the toilet work, you'll smell something. Similarly, you'll smell something wherever we accumulate trash, be it in PMM for temporary stowage or ATV in preparation of destructive reentry. But in general, no unpleasant smell onboard! Or maybe I just got used to it already?

Italian translation of this logbook entry: L+11: Tenere l’aria pulita e la toilette efficiente nello spazio, by Paolo Amoroso—AstronautiNEWS.

L+12

Christmas decorations in the ISS Destiny Laboratory. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 12 (2014.12.05)—Wow – where did this week go! It's amazing how fast time flies when you're very busy and you're enjoying what you're doing. On Thursday, Butch and I were both absolutely convinced that it was Wednesday: poor Terry had to show us OSTPV (our electronic planner application) to make us change our mind!

Talking about planning, the plan for me yesterday was to complete a series of swabs for the experiment Microbiome, for which I have already been collecting urine and blood this whole week. In the morning I took skin swabs at several locations on my face and arms. Later I repeated some of those swabs after exercising and I took surface swabs at some highly-touched locations on ISS: the ARED lift bar that we use to "lift weights"; the knobs we rotate to open and close the shutters of the Cupola windows; the handheld microphones and so on. As usual, everything goes into the MELFI freezer for return whenever the sample can hitchhike a ride back to Earth.

I also relocated a SAMS unit in Columbus: SAMS units are installed throughout the Station and measure acceleration. If we were in a condition of perfect microgravity SAMS would measure zero acceleration. But of course, although we float around weightless, we don't have perfect microgravity on ISS; any input on structure, be it from a pump running or from someone pushing off a handrail, causes a little acceleration locally that the SAMS units can measure.

Looking back at the work week, I've tried hard to become better at not letting things float away: remembering to properly close a bag full of items, even if I'm turning the other way only for a few seconds; scanning the area in 3 dimensions before leaving a work area; properly securing things with Velcro or bungees, even if it seems like a good idea to just press them beneath the knees or stick them under a handrail… it's not a good idea.

On the positive side, though, the fact that things float also means that you have the third hand you always wanted, or the fourth, or the fifth… Let's say you need both of your hands to do something, but you're holding something: well, as long as you don't turn away, you can just let it float. A "third hand" will keep it floating in front of you, you just need to give it a gentle push if it starts to get out of your field of view. There's something magic indeed about a weightless environment! And it's interesting how you have to learn that: I have heard several times Butch telling me "Just let it go."

Last thing I'll tell you tonight: Butch has set up our Christmas tree in the Lab and even hung socks for the six of us. So from now until Christmas, if we come across someone's favorite dish when searching through a food container, we can stick it in his or her sock!

Italian translation of this logbook entry: L+12: Il tempo vola via, come un oggetto in assenza di peso, by Paolo Amoroso—AstronautiNEWS.

L+13, L+14

Samantha Cristoforetti reads the bar code of a food container. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 13 and 14 (2014.12.06-07)—Another weekend has gone by and it's time to get ready for a new week of work on humanity's outpost in space!

As I wrote last weekend, Saturday is the cleaning day. It's also the day when you have some more time for personal hygiene, when you can take a luxurious bath… ehm, just kidding. But, in space terms, it's still a luxurious day: you may choose, like I do, to inaugurate your fresh, clean, new towel on Sunday. It's not exactly shower size, more like what you would use in your home for drying hands, but it's still nice.

We also get a "shower in a bag" every second day: it's one of those camping towels that you impregnate with water – most of ours come wrapped in an pouch with the same interface for the water dispenser as the drinks, so you can dispense water directly into the bag without spilling any drops around.

And we have a pouch of liquid soap every second week. So, recapping, wash with your camping towel and the liquid soap, dry with your weekly real towel. We also have a washcloth per week, I typically use it for drying off sweat during exercise for one week, the next week it graduates to spitting towel for toothpaste. I know, I'm high-maintenance: many astronauts just swallow it.

Hey, if the spitting in the towel was already too much information for you, you might want to stop here, because it gets better. How about cutting your fingernails in space? I am a bit embarrassed to admit that I had postponed this operation until yesterday, because I was a bit intimidated by it. How do you make sure that your don't lose a cut-off piece of fingernail in the cabin, which could end up in somebody's eyes? That would be very poor space etiquette. People have told me that you do that close do a ventilation return grid, but I wasn't 100% convinced that it would go smoothly. Anyway, I'm happy to report that it worked great. I found a return grid with a very fine mesh and a robust airflow and I carefully cut my fingernails just in front of it and sure enough, all the pieces went in the right direction and stuck to the surface of the grid. In the end I only had to vacuum clean.

Another thing we like to do on the weekend, if it sort of matches the prescribed usage rate of food, is to refill our boxes of dishes in Node 1.

Food supplies are organized by type, like meats, vegetables, fruits and nuts, breakfast, etc… when we get a new package out, like the one I'm holding in the picture, we scan it and move it to the "deployed food" location in the inventory system, so the ground always knows where we stand with food. Little boxes, like the ones you can see in the left part of the pictures, serve as our kitchen shelves to store the deployed food packages in Node 1. There's a label on the front of each box to note the date on which that type of food was last replenished: this way we can make sure we're not going through the food too fast!

Today I have take over from Terry what we call "The Duty", a weekly rotation involving a number of administrative and housekeeping responsibilities: turning on the lights in the morning, turning them off in the evening, closing the shutters of the Cupola windows at night, but also running our Daily Planning Conferences with the control centers and keeping an eye on the Daily Summary. This latter is a document that is uploaded every morning to ISS and contains some critical information for the safety of the Station (for the case we had a major failure and we went Loss of Com with the ground), as well as a Q&A section: questions for the crew and answers to questions the crew had earlier. It also has the manning roster of all the control centers for the shifts of the day, so we can always know who is on console in Houston, Huntsville, Munich, Tsukuba and Moscow.

Italian translation of this logbook entry: L+13, L+14: Igiene personale e riordino della dispensa nel sabato del villaggio spaziale, by Paolo Amoroso—AstronautiNEWS.

L+15

Samantha Cristoforetti with a brine tank in the ATV-5. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 15 (2014.12.08)—Today I got to float all the way back to ATV again, this time taking with me a big full tank of brine.

What is brine, you may ask? Let's put it this way: brine is what is left over when we are done "transforming yesterday's coffee into tomorrow's coffee", as fellow astronaut Don Pettit famously said (not sure if he was quoting somebody else!).

As you might know, we recycle urine onboard thanks to a facility called Urine Processing Assembly or UPA. You put urine from the toilet into UPA and you get two products out: one that will become potable water after some further work in the Water Recovery System and then the waste, a concentrate of all the stuff in your urine that you really don't want to be part of your future cup.. ehm, pouch of coffee.

The brine is collected in the recycle tank: when this is full, we take it out and float it down to ATV to transfer it into one of the big liquid tanks - of course, once we’re done pumping out any water that might have been launched on ATV in that specific tank!

Only the toilet in Node 3 is directly connected to the Urine Processing Assembly. In the Service Module toilet, mostly used by our Russian crewmates, the urine is collected in a tank. Of course, for our water balance onboard we need to process that urine as well, so periodically some full urine tanks will materialize in a temporary stowage location in Node 1 and we will progressively transfer the urine to the UPA.

If you’re one of those who find this somewhat disturbing or even disgusting, try to look at it this way: our spaceship Earth is, among many other things, a giant UPA. We’re just not used to think about the previous history of those molecules of water in our drink: wouldn’t make much sense, would it? On ISS we don’t think about it either!

By the way, I have to plead guilty and admit that I have not contributed to the water balance at all today. But it’s for a good reason: science! I am doing a 24-hour urine collection, so we’ll have to detract from our onboard water all my filled tubes, frozen in the Melfi freezer by now. It’s one of those things that you’re a bit nervous about the first time, because it’s easy to make a mess in weightlessness, but I’m happy to say that it turned out to be smooth and easy!

Italian translation of this logbook entry: L+15: “Trasformare il caffè di oggi nel caffè di domani”, by Paolo Amoroso—AstronautiNEWS.

L+16, L+17

Samantha Cristoforetti and Barry Wilmore repair an EMU suit. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 16 and 17 (2014.12.09-10)—In the past two days Butch and I did many hours of maintenance on an EMU suit and this was without a doubt the most difficult and delicate activity that I have performed on orbit so far.

The EMU is the NASA pressure suit for spacewalks – basically, it's a little spaceship for one person that can keep you alive outside of the Space Station for several hours, providing oxygen for breathing and pressurization, cooling water, scrubbing of CO_2, communication and probably a few more things I am forgetting.

One of the most important components of the life support system is the Fan-Pump-Separator, FPS for friends. It's one single, surprisingly small unit containing the fan that provides ventilation, the pump that circulates cooling water and the separator that removes condensate water (from sweat and breathing) out of the ventilation loop, to keep humidity under control in the suit and prevent fogging of the helmet.

The FPS has failed on the suit that is intended to be used by Terry in January and we flew a replacement part with us on the Soyuz, which Butch and I got to install. What makes this work so difficult is that is wasn't originally intended to be performed on orbit, so the design is not weightlessness-friendly.

For example, the screws are non-captive: not a trivial detail when you're trying to remove and then install tiny screws with multiple washers in difficult-to-access places.

So, how do you approach a task like this? Well, for one thing, with a lot of eyes: not only ours, but also of a team of specialists on the ground following along on multiple camera views. Then you have a person on the ground serving as CAPCOM for this particular activity, who is extremely familiar with all the aspects of the procedure: how nice that this person was Mark Vande Hei, from our NASA sister class of 2009. Always nice to talk to Mark!

Then you have a very well-honed procedure and a number of videos detailing every step, in addition to special measures such as putting a mesh on the head of a vacuum cleaner and have it placed appropriately to catch any part that you might lose hold of. And then you need to take it very slow and be extremely meticulous about every action and about tracking parts and tools. Butch and I joked that we were performing surgery on the suit.

So, the new FPS is in place and Butch is scheduled for the checkout tomorrow – hopefully that will confirm that we have a functioning suit for Terry to use in January. Which reminds me that the astronaut profession really requires an extra measure of faith and trust in your fellow human beings. For example, in your crewmates, who replaced a component your life will eventually depend on!

Of course, it's not only trust, we do have a checkout planned: in fact Butch will perform it tomorrow. So it's still early to cheer, but if everything goes well it will be very rewarding to look back at this challenging work!

Italian translation of this logbook entry: L+16, L+17: Un intervento *chirurgico… su una tuta spaziale!, by Paolo Amoroso—AstronautiNEWS.*

L+18

Samantha Cristoforetti trains on ARED. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 18 (2014.12.11)—First of all, if you read yesterday's logbook you'll be happy to know that the Fan-Pump-Separator that Butch and I replaced in the past two days is working nominally: Butch ran the checkout procedure with great results! I was in the middle of my workout on CEVIS, our space bike, when he floated out of the airlock to announce the good news we had been hoping for: believe me, I didn't mind a bit being interrupted!

Today we spent quite a bit of time preparing for the arrival of the cargo vehicle Dragon in a couple of weeks: we had time on our schedule to review some onboard training material about the approach and capture operations and we even had a video conference with the NASA team in Houston who will work Dragon, including the instructors responsible for our upcoming proficiency training, which is meant to make sure that we'll be ready to welcome Dragon to ISS.

Other than that, I feel like I have a spent a lot of time around ARED today, our Advanced Resistive Exercise Device. It's the extraordinary machine that allows us to perform the exercises that we do on the ground with weight… in weightlessness!

There are two main types of exercises you can do on ARED: using the big bar, which moves the main arm upper down (for example squats, deadlift, shoulder press…) or connecting a short bar to a cable (for example bent-over rows, bicep curls or even crunches). Today I got to dive in the belly of ARED and replace the ropes that transmit the load from the cable around a number of pulleys. After that I moved on to do my daily workout, except that this one was special: I had a privatized communication channel with Cologne, where my sports trainer, my physiotherapist and my flight surgeon were gathered to watch my exercise session on a private video downlink and to give pointers to perfect my form. Very important not to get hurt doing exercise up here!

Unfortunately, we also had a cable break on ARED today: well, it's not like it snapped, but we noticed some fraying in the steel threads, which makes it unsafe to use and makes it impossible for now to perform upper stop exercises: that's because this cable allows the main arm to rest on a higher stop, so you can for example do squats or heel raises – when you let go, the bar will remain high. Without this cable, there's no way to prevent the bar from going all the way down to the platform, for example at the end of your squat set – so we are limited now to lower stop exercises like deadlift or shoulder press. We can still of course do all the cable exercises!

We worked until well past dinner time to replace the cable, but unfortunately there's been a few hiccups and it's not quite ready yet: hopefully soon!

Hey, you might notice [in the picture] that I am wearing a little something on my forehead: that's for the ESA experiment Circadian Rhythms. For about 40 hours I have to wear that sensor on my forehead, as well as an identical one on my sternum and the unit that records the data. The sensors continually measure and record my body temperature, providing data that will help researchers understand circadian rhythms in space. It's quite the fashion statement, but also a bit itchy now and then, so I'll be happy to have completed my duty for science and remove the instruments tomorrow!

Italian translation of this logbook entry: [L+18: Mantenere in forma il fisico e gli attrezzi ginnici](), by Paolo Amoroso—AstronautiNEWS.

L+19

Samantha Cristoforetti and Barry Wilmore are trained to capture the Dragon cargo with the ROBOT simulator. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 19 (2014.12.12)—Yesterday Butch and I started to seriously get ready for the arrival of the Dragon resupply vehicle next week.

Butch will be M1 for this capture, meaning that he will have the hands on the controllers of the robotic arm in the final stages. At that point, Dragon will be holding position at the capture point, at a distance of about 10 meters from Station and with its grapple fixture roughly aligned with arm end effector (that’s the “end” of the robotic arm, which has snares that can capture Dragon’s grapple fixture).

After receiving a “GO for capture” from Houston, Butch will fly the arm towards Dragon, compensating any relative movement the vehicle will have to keep the end effector aligned with the grapple fixture and, once on the grapple pin and at the right distance, he will pull the trigger to close the snares and capture Dragon.

While Butch will focus on this, as M2 I will support by "running the procedure" (making sure we don't miss any step) and by having recovery/response steps ready for any malfunction we might encounter in the different stages, from Dragon misbehaving to issues with our robotic arm.

I will also take care of com with Houston and I will support in the final stages by giving Butch information on remaining distance to cover and closure rates, since he will be fully focused on alignment with the target. I will also send Dragon the "free drift" command, probably around 2 meters: at that point Dragon will stop controlling its own attitude and will keep whatever translation and rotation rates it has. We don't want to send the command too early, but we're also not allowed to get closer than 1.5 meters without confirmation that Dragon is in free drift. As you can imagine, we don't want to make a rigid mechanical connection to a vehicle that is firing thrusters to orient itself: the Station is also actively controlling its attitude all the time and we don't want Dragon and Station to be fighting each other!

Fortunately, we have a great simulator onboard to practice all this: it's called ROBOT and it includes hand controllers just like the ones of the real robotic workstation and a big monitor with virtual control panels for cameras, robotic arm and Dragon.

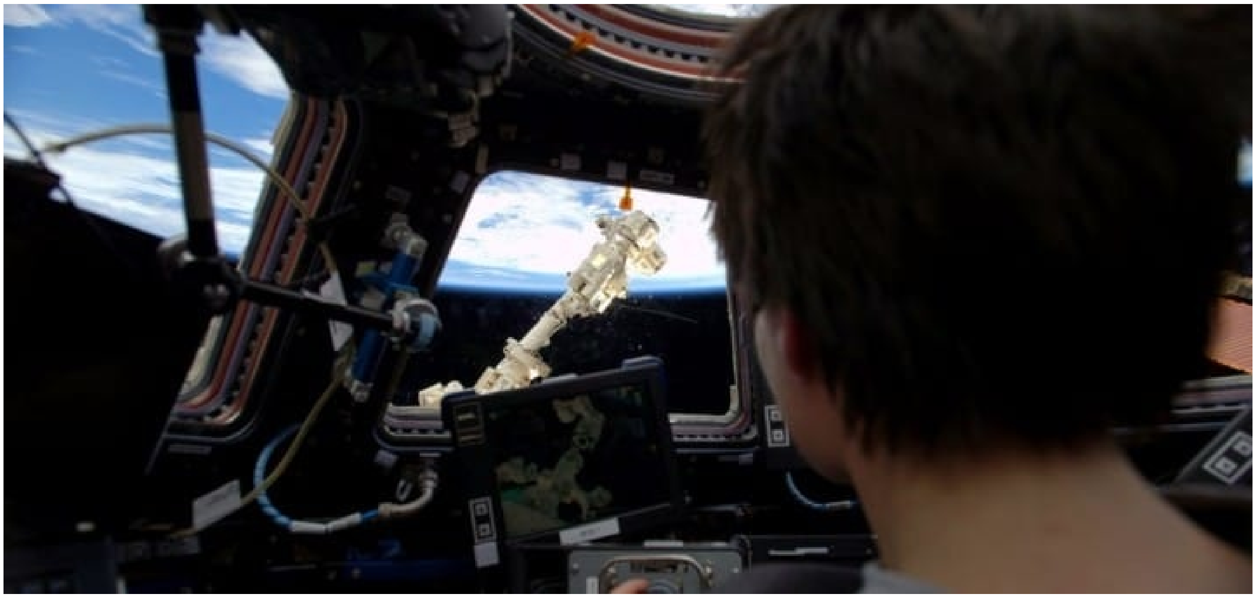
Butch and I had our first scheduled session yesterday: our robotics instructors were running the simulator setup remotely from the ground, observe our work real-time and give us feedback over a privatized space-to-ground channel. Like having them onboard with us! And of course, since you never know what happens, I also get to practice the capture.

Hey, I got so carried away talking to you about Dragon capture that I forgot to mention the science I did yesterday: with the help of Terry and our remote guider Dave on the ground, I took ultrasound images of brachial artery, carotid artery and heart (challenging!) for the experiment CardioOx. I will have several more sessions in the next months, so we'll have more chances to talk about it.

Have a great weekend!

Italian translation of this logbook entry: [L+19: Prepararsi all’arrivo di Dragon](), by Paolo Amoroso—AstronautiNEWS.

L+20, L+21



Samantha Cristoforetti practices the ISS robotic arm for the arrival of Dragon. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 20 and 21 (2014.12.13-14)—My third weekend on ISS is coming to an end and I find myself being very ambivalent about the passage of time. On the one hand, days have just flown by and it seems like yesterday that we arrived. On the other hand, the time when I used to walk and sleep in a bed almost seem like distant memory and it feels like I've always floated, always slept in a sleeping bag, always run on the wall and lifted weights on the ceiling. In other words, the Space Station is starting to feel like my home and my normal life.

Then I get to fly a huge robotic arm lurking in the darkness outside our window, with the Earth passing by beneath, and I still wonder if it's real or if it's a dream. That's right, Butch and I spent some time in the Cupola yesterday at the controls of the robotic arm in preparation for Dragon capture next week. After hundreds of hours of simulation, it was my first time moving the actual Station arm!

I have told you in the last logbook about our onboard simulator, Robot. Sim time is good, but it's important to get a feel for the real arm before capture day. That's why Saturday afternoon we got to practice so-called "offset grapples".

Our target was the grapple fixture of Dextre, the multiarm roboto currently living outside on the Lab, and the starting position was a high over about 5 meters above the target. I messed up the alignment for Butch and he got to adjust it on the fly while approaching the grapple fixture, then we swapped roles and I got to do the same.

Of course, we didn't really grapple Dextre: in fact, triggering closure of the end effector snares was not even enabled on the hand controllers. The purpose was purely to get a feel for how the real arm responds to inputs, especially in terms of oscillations. I was actually surprised by the steadiness of the real arm: it seemed less of a challenge than in the simulator to keep the oscillations under control. I should tell you that oscillations are the big enemy, therefore we train to give very smooth and progressive hand controller inputs. One jerky movement and the arm can start to oscillate more than you like it.

With Dragon arriving next weekend, we have a busy week ahead of us. We'll get probably half days off on Friday and Saturday and, of course, we'll have a full working day on Sunday with the arrival of Dragon. In fact, after Capture Dragon will be berthed to the Node 2 Nadir position, so we'll have it just outside our crew quarters, almost like adding another small room to our living area. And this room will come already full of goodies!

Italian translation of this logbook entry: L+20, L+21: Esercitarsi con il braccio per afferrare Dragon, by Paolo Amoroso—AstronautiNEWS.

L+22

Samantha Cristoforetti in his first amateur radio contact with schools. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 22 (2014.12.15)—Yesterday I had my first HAM radio contact with school pupils. A big hello to the students of the schools “Elena di Savoia” in Bari and “Alessandro Volta” in Bitonto! It was fun talking to you and thanks for the great questions!

Amateur radio contacts between astronauts and school kids have a long tradition on ISS, thanks to a little army of volunteers in many countries who work with the local schools not only on the day of contact, but also in the weeks and months leading up to the event: they teach students about radio technology and about space, to get them ready and hopefully excited about the event.

From my side, I only needed to be ready on the proper channel at the proper time: it is very important, because we need direct line-of-sight with the amateur radio station on the ground and the pass is only about ten minutes long. A couple of minutes before the expected acquisition-of-signal time, I started making calls to check if someone was already picking me up. Eventually I picked up a call from the ground station and sure enough, we started our conversation. I heard them loud and clear, which positively surprised me: somehow I expected signal quality not to be as good. I hope they had the same quality on the other side.

On such contacts, there's no time for small talk and formalities: in less than ten minutes, we had to make sure that the 20 students who were lined up to ask their question got their chance. So here I was, ready to go. And here came the first question – are you ready? Here's it is:

> "It is known that people become taller when they are in space. What happens to bio-molecules? Is there any alteration in the tertiary structure of proteins?"

I almost fell off my chair… well, if I had had a chair. (Wonder what a good equivalent of this expression would be in weightlessness… any suggestions?)

Where are the good old question about space food and the space toilet? Jokes apart, I was really impressed with all the questions: they showed a great interest and knowledge in science and technology and gave me great hope for our future generations of scientists and engineers. Keep up the great work, girls and boys!

Italian translation of this logbook entry: L+22: Terra chiama spazio, by Paolo Amoroso—AstronautiNEWS.

L+23

Samantha Cristoforetti with Spheres satellites. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 23 (2014.12.16)—You likely missed the memo, but I'm letting you know now: tonight is a Marangoni night! At least here on the Space Station.

We like to joke that it sounds like some trendy dance party (I wonder… can you dance in space?), but it's actually quite the opposite: on Marangoni nights we're asked not to exercise and to be particularly gentle in pushing off handrails. And we really should stay clear of the Ryutai rack in the Japanese laboratory, where the Marangoni experiment runs: this experimental protocol is very sensitive to G-jitter – call that the small accelerations we impart on the structure – therefore we need to be careful. So, whenever you want a quiet evening being a couch potato, we can say you're having a Marangoni night!

As the name implies, this investigation is about Marangoni convection. What, convection? Isn't it true that you don't have convection in weightlessness? Well, yes, if you mean the natural convection induced by density differences: for example, on Earth hot air rises because it's less dense than cold air. But not in weightless conditions, because buoyancy is an effect of gravity! However, Marangoni convection happens at the surface of a liquid and is in fact driven by surface tension or, more precisely, by differences in surface tension induced by temperature. Sounds fancy, but if you've observed oil in the center of a hot pan moving to the sides, you've observed some Marangoni convection.

Space is the perfect place for Marangoni studies: first of all, as we already mentioned, we don't have density-driven convection to confuse the observations. But you can also do some neat tricks that on Earth wouldn't be possible: the experiment that is currently running makes use of a liquid bridge that could never be obtained in that size on Earth – it would collapse under its own weight!

Hey, I got so carried away with Marangoni that I didn't tell you about my day at all. First I spent the morning working with Elena on Spheres, as you can see in the picture. I'll write more about Spheres in the future for sure, but for now I'll tell you that we did a test run in preparation of the finals of the ZeroRobotics competition in January. We had a lot of fun and I'm sure we'll have even more fun when we'll have the competing student software loaded on the Spheres satellites!

Butch and I also did another session of offset grapples, similar to what we did on Saturday, in preparation of Dragon capture. We even practiced a transition to our backup robotic workstation in the US Lab, to be prepared for a malfunction on capture day.

Italian translation of this logbook entry: L+23: Serata Marangoni sulla Stazione Spaziale!, by Paolo Amoroso—AstronautiNEWS.

L+24, L+25

Samantha Cristoforetti takes images of an eye with an ophthalmoscope. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 24 and 25 (2014.12.17-18)—The big news of the day here on the Space Station is that we're not going to grapple Dragon on Sunday any more: as you might have heard, the SpaceX-5 resupply mission has been delayed for a few weeks, and now of course the teams on the ground are working hard to replan the days ahead to make good use of our time up here as all the SpaceX-related activities have disappeared from our timeline for now.

In particular, tomorrow was supposed to be mostly a day-off, in view of a very busy Sunday working on Dragon arrival, but now we're back to a regular working Friday and an off-duty weekend. During our evening Daily Planning Conference with the control centers the typical opening call from Houston "The plan is onboard" was replaced by "The plan is NOT onboard", meaning that the planning teams were still working out the details of our schedule for tomorrow – it will be finalized in the next hours and uploaded during our sleeping period, so we'll be ready to go tomorrow morning.

Yesterday I got to work with Japanese airlock again: Butch and I removed the satellite deployer that was installed on the slide table and, with the real-time assistance from the JAXA control center in Tsukuba, we did some inspection work to troubleshoot an anomaly with some limit indicators (the sensors that tell you the current position of the slide table).

These have also been a couple of intense ocular health days for me: there's been a great deal of focus in recent years on the eyes, since we've become aware of some vision degradation in many crewmembers of long duration mission. The jury is still out on the exact cause and it's therefore important to gather a lot of data. I started yesterday with a relatively simple vision acuity exam, not much different from what you probably know from your eye doctor visits. Then Terry measured the pressure of the fluid inside my eye bulb by gently tapping the surface of the eye with an instrument called tonometer (did I mention already that we really have to trust our crewmates up here?).

And today we got images of the eye using two different instruments: a fundoscope (which is the one in the picture) and a tomography machine (specifically, if you're savvy about these things, which I am not, an Optical Coherence Tomograph). All these tests require the assistance of another crewmember, interacting with a remote guider on the ground who has real time images from the equipment and a camera view of us working up here.

That's not all, though: tomorrow we'll also do an eye ultrasound!

Italian translation of this logbook entry: L+24, L+25: Vederci chiaro sulla vista, by Paolo Amoroso—AstronautiNEWS.

L+27, L+28

Samantha Cristoforetti with a new pair of green trousers. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 27 and 28 (2014.12.20-21)—I'm the Station's night owl tonight, everybody else is already asleep in our little ring of four crew quarters in Node 2.

I like listening to the sounds of the Station at night. People sometimes tell me that they would like to hear the utter silence that they assume I hear in space, but the famous "In space no one can hear you scream" only applies to the vacuum of space: fortunately inside the Space Station we have a breathable atmosphere at about the same pressure you have on Earth at sea level. Plenty of molecules nicely tight together happily transmitting sound throughout the cabin.

There is always a significant background noise, due to the many fans and pumps running all the time: a constant humming that signals that the Station is "alive" and healthy. In fact, if we had an emergency, like a fire or a depressurization, even if the audible alarm wouldn't go off we would immediately notice it because the Station would go quiet: the computers implement an emergency auto-response that shuts down the ventilation.

Some noises have taken me by surprise occasionally. Like the first time I noticed a different noise in our toilet cabin, accompanied by a distinct vibration I could feel through the foot restraints on the “floor”. Turns out it’s a normal occurrence when the ground controllers are running the urine processing assembly in a certain mode.

Or one day, as I was floating out of Columbus, I heard one of our science racks making a loud hissing sound for several seconds, then go quiet. I checked with Col-CC in Munich and it turned out that they were doing some commanding of our Electro Magnetic Levitator from the ground. So, all expected!

It’s quite common for the ground to send commands remotely. Most of what we do up here as crew are tasks that require us to be hands-on on hardware: all commanding of the station systems and science experiments that can be done from the ground remotely are typically implemented by the ground controllers on console in the different control centers. And it’s probably better to have the specialists for each system send commands to the Station.

It’s also a way of saving precious crew time: for example, many maintenance procedures have safing steps at the beginning to make sure that the equipment is not powered and is in a safe configuration. Mission Control is always ahead of us and they will have safing in place before we get a chance to ask.

So, as you can imagine, running the Space Station requires a lot of communication and coordination between crew and teams on the ground. And we can always count on dozens of specialists looking over a constant stream of telemetry to make sure all systems are healthy up here. Or even to help us out with little things like disabling smoke detectors: we have to do that in most modules before vacuum cleaning the filters on the weekend, to avoid the risk of triggering a false smoke alarm with dust, and we always get a helping hand from mission control to get that done.

Hey, I’ve been in space for almost a month now, which means that today was new-pants day for me! Yep, we get six for the mission, so today was time to see what was on offer in my space wardrobe. I actually thought that I would get six identical pants, but… surprise! This will be a green-pants month. I love these pants, by the way, they are very comfortable and practical, with plenty of pockets and Velcro stripes to secure things. Pockets are also all rigorously closed with Velcro, to prevent things from floating out. That’s because, as a rule and with no exceptions, things always want to flow out in space.

Italian translation of this logbook entry: L+27, L+28: Ascoltare i rumori della Stazione Spaziale di notte, by Paolo Amoroso—AstronautiNEWS.

L+29

Samantha Cristoforetti replaces an MSL rack cartridge in the Destiny laboratory. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 29 (2014.12.22)—Today I had a short task in the afternoon that required me to measure the airflow velocity at a ventilation outlet in ATV, our European cargo ship.

ATV is docked at the aft docking port of the Russian Service Module, which makes it the furthest place we can go to from the non-Russian modules of the Space Station. And this is not a small Space Station! From the most forward module, Node 2, where our crew quarters are, it's about 70-80 meters back to ATV. Since we operate on a pretty tight schedule here, having to go back and forth can cause delays, that's why I really try to make sure I have everything I need before I head down there. However, as an additional measure, I am proud to say that I have optimized the flight path. And here's my conclusion, in case you're curious: the fastest way to ATV from the forward modules is flying belly "up" towards the overhead.

Plenty of good handrails in the Lab and Node 1, plus when you arrive to

PMA, the adapter element between the Node and the Russian segment, the deck slopes up and the passage becomes quite narrow: if you're flying on the overhead, though, you can keep on going straight.

Then there is the FGB, which is a lot of fun: it's like a long narrow tunnel with closely spaced handrails along both walls. In the FGB overhead or deck wouldn't matter, but once you get into the Service Module, the overhead is where you want to be: the deck and the walls are full of equipment and stowed items that would force you to slow down. Plus the Service Module interior design is made very much with a virtual "up and down" in mind, so Sasha, Anton and Elena are mostly feet on deck. By flying overhead, I can stay above their heads and get to ATV without getting in their way.

OK, that was probably more detail than you wanted to know. Sorry, I got carried away. But these little things really make a difference up here. Like figuring out the best way to stabilize yourself at a worksite: it's something that we stress a lot during EVA training, but I have found that it is just as important inside.

Today I had a tough one: I had to remove a used cartridge from the Material Science Laboratory rack, which is located on the Lab overhead. But the neighboring wall has the frame of the CEVIS in front of it (our space bike), which is free to move to avoid transmitting load into structures and hence doesn't provide a stable hold. The other wall has the Combustion Integrated Rack (CIR), which was also "floating" for an experiment run and was not to be touched at all. And the nearby rack fronts along the overhead have plenty of equipment and cables. Quite a challenge!

And sometimes the only way to get stabilization is to have a crewmate help. We're not shy up here about asking to hold on to somebody's leg when needed.

Italian translation of this logbook entry: L+29: Volare a pancia in su nella Stazione Spaziale, by Paolo Amoroso—AstronautiNEWS.

L+30

Samantha Cristoforetti Inserts blood samples into a centrifuge. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 30 (2014.12.23)— Happy 24th of December! It's Christmas Eve, of course – a very special time for many people on Earth and for us on the Space Station. Much more humbly, it's also the 1-month mark for Terry, Anton and me: on the 24th of November we arrived to our new home in space. Time flies, doesn't it?

One of the peculiar things about living up here on ISS is that you have no commute at all. I'm fortunate that I never had significant commutes to school or to work in my life, but this beats them all: you wake up in the morning and you are already at work. If you're one of those people who enjoys the commute as a buffer time, you'd be in trouble!

The first thing I do in the morning before even fully getting out of my sleeping bag is to open the lid of my laptop in my crew quarter and check the day's plan on the electronic agenda, called OSTPV (On-Board Short Term Plan Viewer, or something similar).

We typically get the plan the night before, but changes could have been uploaded during the night. Moreover, during our post-sleep period in the morning there could be very short activities that are actually reminders: for example, no caffeine today for 2 hours before a certain experiment; remember that you're closing up a urine collection this morning; no exercise this morning before 5 and 7 (not that I would be a candidate for that, but some crewmembers are early risers and enjoy working out in the morning).

This morning my day started again with a meeting with… Terry the Vampire! Just kidding, of course: Terry is a great Crew Medical Officer and always does an awesome job with my blood draws. As usual, after taking the blood samples and waiting the 30-minute coagulation time, I put the tubes in our centrifuge for another 30 minutes, before storing them in one of our MELFI freezers, where they will await an opportunity for return to Earth.

A lot of human physiology experiments have a "Flight Day 30" requirement for data so, besides the blood draw, I have been doing another 24-hour urine collection and I have been wearing again the temperature sensors on my forehead and sternum for the ESA experiment Circadian Rhythms. In addition I ran another series of measurements on my skin for the experiment, Skin-B, which I talked about in the L+11 Logbook.

I also got to dive a little bit in the belly of Columbus for a water sampling activity. Water runs in the internal cooling lines of all the non-Russian modules and periodically we need to access the lines via dedicated sampling ports and get some water out. I took two samples yesterday: one will be returned to the ground for analysis; the second one was for immediate testing with an ammonia test strip. Presence of ammonia in the water would indicate some leakage at the interface between the internal cooling lines (water) and the external cooling lines (ammonia): since ammonia is very toxic, that would be a very unfortunate finding. But luckily the test strip didn't show any ammonia in the Columbus water!

Merry Christmas from us all up here on the Space Station!

Video: Christmas greeting from Samantha (Italian) (1:06)

Italian translation of this logbook entry: L+30: Iniziare la giornata con Terry il Vampiro, by Paolo Amoroso—AstronautiNEWS.

L+43

Samantha Cristoforetti and Anton Shkaplerov in the Zvezda service module at New Year 2015. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 43 (2015.01.05)—Sorry, sorry, sorry!

My apologies, I never meant for this logbook to take a break for the holidays, but this is exactly what ended up happening. It’s not been an especially busy time up here on ISS, but I did take some more time for personal matters, friends and family.

So, here we are, almost a week into 2015 already. By the way, as our Lead Flight Director Tomas pointed out (hallo Tomas!) for a full month the calendar date and the GMT date match, so I will actually know what day it is for a change.

Don’t know if I ever mentioned this explicitly, but the Station runs on GMT time, or more properly UTC, which corresponds to the Greenwich time zone. We also like to indicate what day it is by counting up from 1 to 365. In Station jargon, today is GMT 005. Might actually be that GMT is not a correct definition for this, but it’s the usage in the ISS world. It’s easy to see how by, say, GMT 072 you’ve lost track of what the real date is!

GMT 365, of course, was pretty easy to recognize as New Year’s Eve. We had a grand time celebrating multiple times down in the Russian Service module. We started with midnight Moscow-time, of course, and then on to midnight Central European time and finally our own midnight on Station. By the way, many have asked whether we could see any fireworks from space. Unfortunately, the timing didn’t work out very well: from a few days before New Year’s Eve and until today we didn’t have a proper, fully dark night on Station. It was what we call a high-Beta period, a time in which the relative positions of the Sun, the Earth and the Space Station are such that we are never completely without sunlight. In other words, for several days we were flying all the time very close to the terminator, the line between day and night on Earth. The Sun was either just above the horizon, creating very dramatic long shadows on the planet, or just below the horizon, with the twilight lasting until the next sunrise.

What I loved the most was the shades of intense blue and orange that appear on the Earth horizon just before or after sunrise: during high-Beta the time this colorful stripe is visible a lot longer, so you can really rest your gaze on it. But I did miss seeing the city lights and the stars in the darkness, so welcome back night. We missed you!

Hey, at New Year’s Eve we actually danced, you know? Not sure that it looked like dancing from the outside, but since nobody watched besides our close space family here, and we were very much convinced that we were dancing, we danced: it’s our story, and we’re sticking to it!

Sasha and Anton even played songs by Adriano Celentano, a very famous and not-so-young-anymore Italian singer. He is to this day incredibly popular in Russia and I have yet to meet a Russian who doesn’t know his most popular tunes.

Which brings me back to a story from our launch I’d like to share. As you might remember, Terry, Anton and I each picked a few songs that were played to us in the last 40 minutes before launch. Anton decided to include a few Celentano songs and selected one of his favorite tunes, without having any understanding whatsoever of the lyrics. So imagine my surprise when, sitting on top of a rocket with the hatch closed and the access towers retracted, I hear these words in my headphones: “E’ inutile suonare qui non aprira’ nessuno, il mondo l’abbiam chiuso fuori con il suo casino!” which translates as “No point in ringing the bell, nobody will open the door; we have left the world and its chaos outside”. Talk about picking the right soundtrack!

Not only we had locked the world outside (or the world had locked us inside), but we were space-bound! After a few hours we arrived to the Space Station – that was an early morning 42 days ago, by the way. A good occasion for a friendly reminder from your friendly Expedition 42: “42” is the answer, so don’t panic and always know where your towel is!

Italian translation of this logbook entry: L+43: Capodanno nello spazio, by Paolo Amoroso—AstronautiNEWS.

L+44, L+45

Samantha Cristoforetti changes the toilet's pre-treatment fluid of Node 3. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 44 and 45 (2015.01.06-07)—Today it's Christmas again! That's right: Russia, a predominantly Orthodox country, celebrates Christmas on January 7th, so last night we had a Christmas Eve get together with our Russian crewmates.

On the Space Station this is typically a day off in the Russian segment only, but today Terry, Butch and I also got a free day, because we expect to work on the weekend following the arrival of Dragon. We were therefore free to join Sasha, Elena and Anton on their videocon with their families, who had gathered in Mission Control Moscow.

Father Ioav, the very kind Star City priest, even brought in a small choir to sing Christmas songs to us, including the Italian favorite "Tu scendi dalle stelle" beautifully performed with impeccable pronunciation!

Looking back at yesterday, I performed a third run of the ESA experiment

Skin-B, studying the effects of space environment on the skin: if you missed it, I talked about it in greater detail in the L+11 Logbook.

I also got to dive into the bowels of our space toilet again: in that same L+11 Logbook I mentioned refilling the flush water tank, this time I changed the pre-treat tank. Pre-treat is a fluid that is added in small quantity to flush water and provides some chemical treatment of the urine. There is a component, called dose pump, that provides the necessary pre-treat quantity at the beginning of every use. In fact, every time we turn on the toilet (which means turning on the fan that provides suction) we need to check for the dose-pump light to come on for a few seconds and then go out. If it doesn't, there is a problem. This happened to me just this past Sunday, actually: the dose pump light did not go out and a red fault light came on instead. After some troubleshooting lead by specialists on the ground, the conclusion was made that the dose-pump had failed and Terry had the replacement on his schedule for Monday.

Before this could be successfully completely, the Node 3 toilet was out of service. Luckily we do have redundancy onboard: the Russian service module has another toilet – in fact that was the original toilet of the space station and the toilet in Node 3 is exactly the same design with some modifications to account for urine transfer directly to the Urine Processing Assembly.

Of course, it's really preferable for us to use the Node 3 toilet: not only it's a lot closer, but we avoid disturbing Anton and Elena, who sleep not very far from the Russian toilet.

As you know, we're also ready to receive the Dragon cargo ship here soon. In preparation for berthing, I got to do something which did feel somewhat disturbing for a moment: I unlatched the Node 2 hatch, which is where Dragon will be berthed. Right now, of course, it leads to vacuum. We do that to avoid any issues with the latch-unlatch mechanism on ingress day: several science payloads on Dragon are time-critical and a delay in hatch opening and transfer could cause a loss of science. Of course, the hatch opens to the inside, so even if the mechanism is unlatched, there is no way it can open against the internal pressure of the Space Station. But I guess I'm not the first one to feel strange about unlatching it: the include a reminder that there is a force of about 39,000 lbf keeping the hatch closed when the modules is pressurized. Btw, this also means that hatches opening to the outside would be a very bad idea (yes, I’m thinking of you, “Gravity”).

Italian translation of this logbook entry: L+44, L+45: È di nuovo Natale, by Paolo Amoroso—AstronautiNEWS.

L+46, L+47

Samantha Cristoforetti and Barry "Butch" Wilmore in the ATV-5. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 46 and 47 (2015.01.08-09)—We're not scheduled to work here on the Space Station this weekend after all, except for the usual cleaning activities. As you might have heard, the Dragon resupply vehicle is not here yet, so we're not rushing to get urgent cargo out and get the science started. The good news is that it's off the ground now. Hurrah and congratulations!

So Butch and I will have a final on-board training session tomorrow to get us ready to capture Dragon on Monday. On Tuesday we'll ingress and start a challenging few weeks of intense scientific and logistics work, before we send Dragon back at the end of its mission.

The mission of ATV5 will also come to an end next month and that's of course a big vehicle to load.

Most of its time onboard it has remained quite empty, because of center of mass considerations in case of an emergency undocking. Fortunately in the past weeks we've had permission to progressively move more and more trash to ATV, which has freed up a lot of space in our stowage module, the PMM, and made it a lot easier to find things in there! In fact, the unfortunate mishap of the Orb-3 mission back in October was not only a loss of cargo, but also meant that we have quite a bit of trash onboard now that would otherwise be gone by now.

Yesterday Butch and I installed adapter plates on top of the filled stowage compartments on the walls of ATV – more bags of trash will be secured to these adapters, so that we fill the internal volume as much as possible. As you can see in the picture, it's starting to look a bit like caving working in there, it's kind of fun!

On Thursday, I also worked with the Spheres again most of the day – you can find more on Spheres on L+23 Logbook. The finals of the ZeroRobotics competitions are approaching fast (good luck!), but this was a actually a series of test runs using a smartphone and its camera, attached to one of the Spheres, to navigate.

I also did some work with our acoustic dosimeters, taking 24-hour measurements of the noise levels in specific locations on ISS. Before that, we all carried a personal dosimeter with us for a 24-hour period, so we all had a big mic attached to our collar. Very stylish!

The loudest place on ISS is by far the immediate vicinity of the T2 treadmill when someone is running on it, especially a fast runner. That's why there is a recommendation to wear earplugs whenever we run: we have custom made earplugs with speakers that protect us from the treadmill noise and at the same time allow us to listen to music while working out.

Besides the dosimeters, in the past holiday weeks we've been tasked with several activities that need to performed periodically to monitor the ISS environment and equipment. One day Terry, Butch and I were all going systematically through the modules: Terry was verifying the condition of all our emergency equipment (the oxygen masks and fire extinguishers stowed throughout ISS); Butch was taking water samples from the cooling lines; and I was measuring the airflow velocity through the ventilation grids, which the ground analyzes to determine if there's any blockage or clogging of the filters.

I guess it's like the periodic inspection on your car, except that the ISS is infinitely more complex and we can't take it to a garage to get it fixed!

Italian translation of this logbook entry: L+46, L+47: Preparare ATV-5 per l'ultimo viaggio, by Paolo Amoroso—AstronautiNEWS.

L+48, L+49

Samantha Cristoforetti receives the astronaut's gold pin from Terry Virts on Christmas Day 2014. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 48 and 49 (2015.01.10-11)—Dragon has definitely been in the center of our thoughts this weekend.

First of all, as you can imagine, after several delays, we were very happy when we saw the successful liftoff yesterday. To be more specific, we watched a replay, we weren’t able to watch the launch live, although we were “tuned in” on NASA TV at that time.

Yes, you heard it right, we can watch TV up here… sort of. There is a videoconferencing system and on one of our laptops, located in Node 1 where we eat, Mission Control can stream a TV channel on our request. I’m not much into TV myself, so most of the time we watch ESPN, a US sports channel that Terry and Butch are very fond of. But for special events like the Dragon launch we request NASA TV.

Unfortunately this is not an interruption-free service, and I’m not talking about commercials. The videoconferencing system (like our email, internet access and two of our four Space-to-Ground channels) only work when our Ku-Band antennas have coverage. Interruptions are quite frequent and can range from a few minutes to even a full hour. The Dragon launch occurred during one of those gaps in coverage, which we call LOS (Loss-Of-Signal).

Anyway, back to our main topic, getting ready for Dragon arrival. Butch and I had a final training session today in which we practiced the capture. I have written about the capture choreography and our respective roles in L+19 Logbook, in case you missed it.

As M2, one of my big responsibilities will be to watch out for any off-nominal signature and be ready to run the appropriate response: we would call that “running the malfunction cue-cards”.

Today I wrote a number on the cue card next to every malfunction and I asked our instructor on the ground to call out a number during the approach and capture, so I could practice mentally determining the appropriate response, without really interfering with Butch’s capture practice.

Since during one of the runs we were in Ku-LOS (see above) and had no com with our instructor, Butch started unexpectedly to randomly call out numbers while he was flying the arm. Great training! And by the way, although we train for the worse scenarios, we all count on Dragon and the arm working flawlessly tomorrow. And Terry will take some awesome pictures: he spent a lot of time today setting up cameras and knowing his skills, it will be good!

Hey, one little thing I would like to share from our past Christmas holidays, actually from Christmas day. Terry was so thoughtful to fly up for me a golden astronaut pin, which you get when you actually fly to space, and he gave it to me as a Christmas present. That was so nice and totally unexpected. And Butch gave me the Soyuz Mach-25 patch. Don’t I have wonderful crewmates?

Italian translation of this logbook entry: L+48, L+49: Un regalo di Natale *da astronauta, by Paolo Amoroso—AstronautiNEWS.*

L+50

Samantha Cristoforetti e Barry Wilmore nella Cupola durante l'avvicinamento del cargo Dragon CRS-5. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 50 (2015.01.12)—My 50th day in space and certainly a big day here on ISS yesterday – as I'm sure you've heard, Dragon has arrived! We now have a new room attached to Node 2 nadir, right next to our crew quarters : all the time I've been up here there was a hatch to vacuum there, now I can make the turn and "dive down" into Dragon. Our home in space just got bigger!

Approach and capture happened in the morning and, at least from what we could tell from our perspective, everything went really well. It was quite touching to watch this vehicle approach ISS and to discern more and more details as it came closer, a messenger from Earth bringing supplies to the only six humans currently not on the planet.

I was impressed at how steady it was as it came up from below us: you could hardly notice it controlling its position and attitude. As it stopped at the last holding point at 30 meters it felt already so close, I couldn't believe that it would get still 20 meters closer before we could grapple it, but of course out there we don’t have many references to gauge distance. It arrived at the capture point, at 10 meters distance, during orbital night, with the red and green lights on the sides reflecting beautifully on the solar arrays. Just after sunrise we got a “GO for capture” from Houston and Butch smoothly maneuvered the robotic arm onto the grapple pin and pulled the trigger to initiate the capture sequence. I had all the malfunction cue cards ready, but fortunately there was no need for them. Everything went perfectly!

After that we safed the arm and ground took control to maneuver the Dragon to its berthing position at the Node 2 nadir port. Once the bolts that create a solid mechanical connection were driven, I received a go to leak check the vestibule: if you’re wondering what that is, let’s say that it’s the space between the doors.

We have a hatch on our side, Dragon has a hatch on its side: when the hatches are open, we need a pressure-tight “corridor” in between that allows us to go through; that is called the vestibule. Just after berthing, the vestibule is at vacuum: if you think about it, it’s outside of the hatch on our side and outside of the hatch on the Dragon side. Before we equalize pressure and open the hatch, it’s important to make sure that the vestibule doesn’t leak. For that purpose I opened a patch between the vestibule and the ISS cabin atmosphere and pressurized the vestibule to 260 mmHg, then verified that the pressure remained stable for 20 minutes. At that point, I fully equalized pressure and Terry and Butch took over to open the hatch and work on reconfiguring the vestibule for the time Dragon will stay on ISS.

At some point, once the hatch on our side was open, Terry invited me to smell the “smell of space” in the vestibule. It’s sort of a joke, of course, space itself doesn’t smell. But it’s apparently the typical smell of hardware that has been exposed to vacuum. Not a pleasant odor, I tell you: I’d say the dominant component is “burned” with a touch of “rotten”. But hey, if that means that a spaceship came to visit, I’ll take it anytime!

Video: the moment when Samantha smells "the smell of space" [subs ENG/ITA]

Video: Expedition 42 - Samantha and the smell of outer space [subs ENG/ITA] (0:34)

Italian translation of this logbook entry: L+50: L'odore dello spazio, by Paolo Amoroso—AstronautiNEWS.

L+51, L+52

The sleeping bag by Samantha Cristoforetti in the Destiny Laboratory on the night of the ammonia alarm on the ISS. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 51 and 52 (2015.01.13-14)—Hello everybody, now that things have mostly returned to normal on ISS, it's time to catch up with the logbooks of the week. And what a week it has been!

Looking back to Tuesday, we got to ingress Dragon and unload all the urgent cargo, mainly everything that needed to be in cold stowage. And then on to Wednesday when, as you might have heard, we had quite some excitement here onboard and in the control centers around the world as the ammonia leak alarm went off.

I had just finished a monthly video conference with my ESA management and I was about to start a review of the installation procedure for the Airway Monitoring experiment on the laptop in my crew quarters, when all the speakers throughout the Station started to transmit the one tone sure to catch everybody's immediate attention: the emergency tone.

[Video: images from outside the ISS and radio communications between astronauts and control centers in the early stages of the ammonia alarm

Video: [Expedition 42 - 2015-01-14 - Ammonia Leak Alarm](#) (41:23)

I came out of my crew quarters and looked at the Lab aft bulkhead, the closest Caution and Warning Panel I could put my eyes on, and there it was, the third light from the left was lit red: even without reading the label, I know that the third light is the dreaded ammonia leak. Not that I cherish the thought of having a fire or a depressurization (the other two scenario that can trigger an emergency alarm), but ammonia, I am told, can kill you really fast. I couldn't distinguish any ammonia odor in the cabin, but I certainly didn't sniff around much: I immediately grabbed an oxygen mask, put it on and headed towards the Russian segment together with Terry, Butch and Sasha. Elena and Anton were in the Russian segment already at the time.

After making sure that nobody was left behind, we closed the hatch isolating the Russian from the American segment of the Station and started to prepare the ammonia measurement equipment and the ammonia respirators. Before I go any further, if you're interested in some background (like why there is a danger of an ammonia leak, or why the Russian segment is a safe haven or how the ammonia response looks like), you can take a look at my training Logbooks: L-140 and L-142.

Back to our story… a few minutes after the tone went off, Houston called and declared it a false alarm, so we stood down from the emergency response and came back to the US segment, finding it of course unusually quiet, since the vehicle auto-response had shut down all of the Station's many fans.

Why a false alarm? Well, looking at the telemetry from Station, the flight controllers couldn't initially find any confirming cues that there was indeed an ammonia leak and everything pointed instead to a computer malfunction. But that was just the beginning of a long day for everybody…

As we were starting to restow the emergency equipment and get back to normal, we received the unexpected call from CAPCOM: "Ammonia leak. Execute emergency response. Ammonia leak, execute emergency response. Ammonia leak, execute emergency response".

As we learned later, Houston had in the meantime started to see some signatures in the telemetry that could possibly indicate a real leak of ammonia into the cabin, in particular a slight increase in the cabin pressure: at the very least, a real leak could not be ruled out at that point any more.

So we put on our masks and took refuge in the Russian segment again. Even more than the first time, I believe that the thought did cross everybody's mind as we closed the hatch: we might never reopen it again.

We went through the full ammonia response procedure and, after swapping the oxygen masks for the respirators with ammonia filters, could confirm with Draeger tubes that the atmosphere in the Russian segment was uncontaminated, hence safe to breath.

We doffed the respirators and eventually we all gathered in the Russian Service Module, eager to hear words from Houston about the suspected leak. We learned that to mitigate the possible leak, the pump in the external cooling loop B had been shut down and that the loop pressure had been reduced, but we were relieved to hear that the ammonia had not been vented from the loop into space: a possible scenario in a situation like this, but also an action that would cripple the Space Station for a long time.

Following the shutdown of the loop, a thermal clock had started for a lot of equipment onboard: if not shut down within a certain time, it would overheat. So control centers in several countries were busy trying to do a powerdown that would have as little impact as possible on Station systems and science.

Samantha Cristoforetti and the ISS crew in the Russian section of the ISS during the ammonia alarm of 2015.01.15. The alarms are marked in red on the computer screens. Credit: NASA

I think you get the point: the control centers had the hard job from now on. We were safe, doing well and with very little to do, except waiting. Knowing what a stressful time the guys and girls on the ground were having, we tried to keep quiet and never asked for any update, patiently waiting for them to call us, which of course they did periodically.

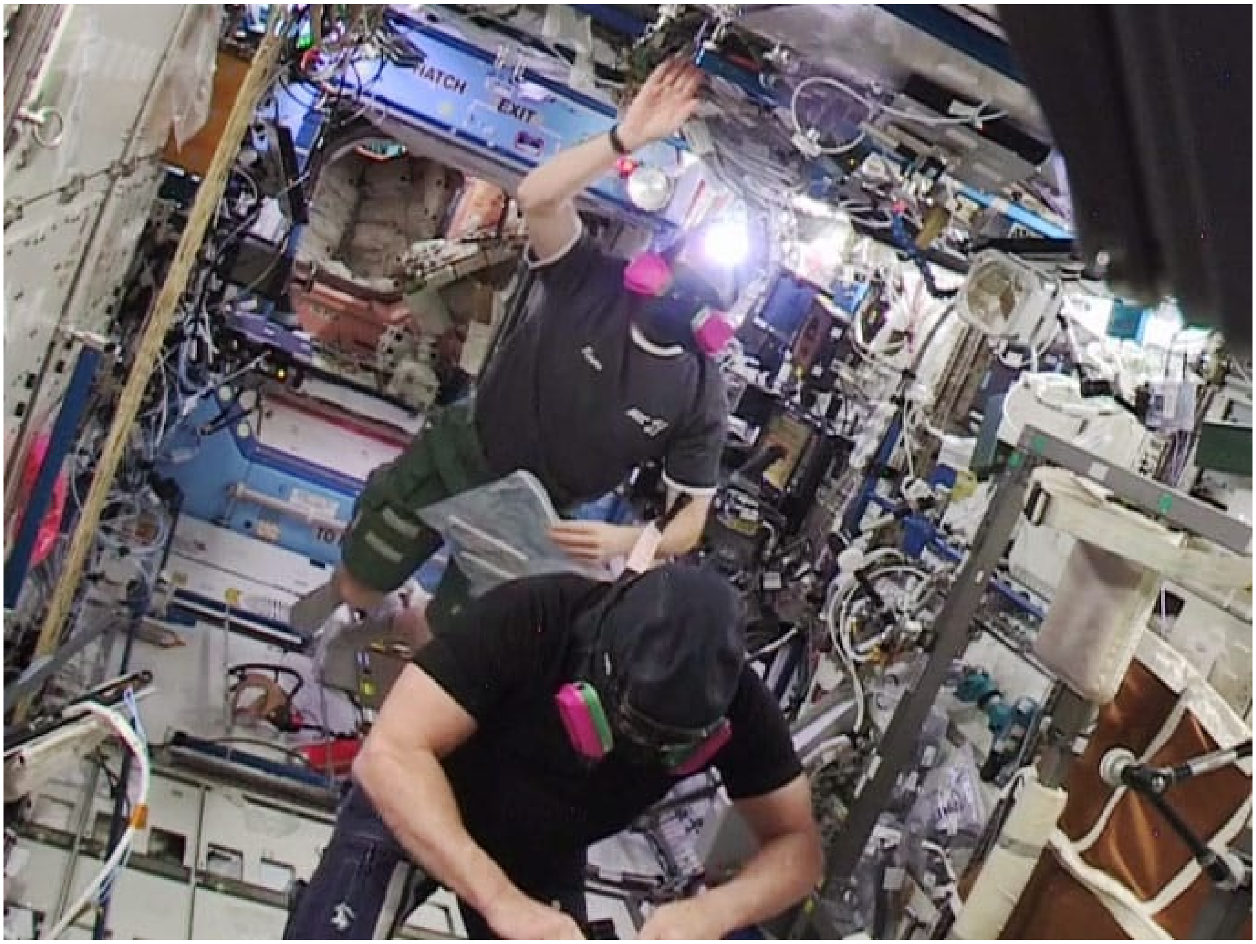
At every update if became more and more clear that everything pointed to a false alarm, but we were not sure that we would be allowed to leave the Russian segment before the next day.

In all of this time, our Russian colleagues were incredibly hospitable. They even gave us three food containers that we could use for ourselves, so we wouldn't feel bad about digging into their containers or asking all the time. When the power was restored to the power outlets I could give a quick call to my family to let them know I was OK. And Elena let me borrow her internet-access computer, so I could write a short tweet and make sure everybody knew that we were doing fine.

> (IT) Grazie a tutti, stiamo tutti bene qui nel segmento russo e siamo al sicuro. Per aggiornamenti seguite @NASA e @Space_Station
>
> — Sam Cristoforetti (@AstroSamantha) January 14, 2015

We didn't know what information the media were reporting and we were concerned that people might be worried about us.

Eventually, in the early evening, we received instructions to reopen the hatch and go back. To be really safe, we all put on our ammonia respirators. Houston directed us to send two people forward to sample the atmosphere first and Butch decided that he and Terry, as the Soyuz right seaters, would go. After a few minutes they called back declaring that the readings were negative and we had the final confirmation: there had been no ammonia leak!



Barry Wilmore and Terry Virts shortly after entering the USOS segment of the ISS on the emergency night of 2015.01.14. Credit: NASA TV

After a day of waiting, we were ready for action: we quickly gathered all the used emergency equipment, restowing what would be reused, trashing what needed to be discarded. We tagged up with Houston about the oxygen masks: how many had we used and how best to redeploy the remaining masks on Station to make sure we were ready to respond to any other emergency. And we took a few actions that could not be performed remotely by the ground to safe equipment following the powerdowns.

Finally, we got ready for bedtime: since ventilation had not been restored in Node 2, Columbus and JEM, we could not sleep in our crew quarters and had to camp out in the aft modules. I setup my camping spot in the Lab: camping in weightlessness is really easy, you just attach your sleeping bag to a handrail and you’re ready for a good night sleep!

By the next day, we were ready to jump back into the busy science program of the next weeks, thanks to the quick re-planning work done on the ground.

By the way, as unfortunate as this event was, in many ways we were lucky: Dragon was fully berthed, all the urgent cold stowage items had been removed, none of us was working on an experiment that would suffer damage if delayed or left unattended.

That would have been the case, for example for the ESA “T-Cell” experiment, which I performed on Tuesday: had the ammonia alarm gone off on that day, we would have lost the science. So, in the end, we were lucky: must be because, on Expedition 42, we always know where our towel is!

Italian translation of this logbook entry: L+51, L+52: Allarme ammoniaca? Niente panico! , by Paolo Amoroso—AstronautiNEWS.

L+53

Samantha Cristoforetti with a fruit flies cassette from the Fruit Flies Lab experiment. Credit: ESA NASA

ISS Space Outpost. Earth Orbit—Mission Day 53 (2015.01.15)—After the unplanned excitement of Wednesday, we woke up on Thursday morning to return to relative normality. Relative, because external cooling loop B was still shut down and unpressurized: due to the possible presence of gas bubbles after Wednesday's events, the re-pressurization was a delicate process that would take the ground a few days to perform safely (Loop B is back online as of today, Sunday, as I'm writing this).

Ventilation was restored that morning, meaning that camping was over and we would be able to get back into our crew quarters, but cooling in Node 2 relies on Loop B, so it was going to be a bit warmer for a few nights (I think that I didn't mind that part at all).

We also had no cooling in Node 3, where we have our treadmill T2, so we did our daily cardiovascular training in the Lab on CEVIS, our space bike. The other modules had cooling because it had been possible to transition them to "single-loop", which entails connecting the two internal cooling loops and have them reject their combined heat load via external loop A, the one unaffected by the previous day's events.

Because of the loop B situation, we were also did not have all the power channels available, causing some limitations, but nothing dramatic: in JEM and COL, for example, we only had half of the lights working and one of the two communication panels available. Nothing that would prevent the science activities to pick up the pace again and shortly after our morning planning conference with the ground, Butch, Terry and I were getting started with our respective experiments and the Space Station was a very busy laboratory again!

Samantha Cristoforetti with the Fruit Flies Lab experiment. Credit: ESA/NASA

I had been tasked with setting up the Fruit Flies Lab. Yes, Dragon brought up some living company in form of about a hundred fruit flies or, to be formal, Drosophila Melanogaster. Actually, by now we probably have more: the point is to observe multiple generations and the short life span of fruit flies makes that possible. And since we share with those tiny fellows about 77% of the genes known to be involved in disease, they are a very interesting animal model!

The flies came up in cassettes, that you can see in the pictures. As I retrieved them one by one from the foam cutouts in their transfer boxes, it was good to see that they were alive and healthy: as far as I could tell, they were very happy astroflies in space!

Each fly cassette was matched to a special food changeout platform, with which I could insert fresh food without breaking containment, while simultaneously extracting larvae for preservation in our MELFI freezer. After the food changeout, I inserted each cassette in a specific location in one of the Nanorack facilities: as it's commonly done in life science experiments, half of the cassette were stowed in a centrifuge to simulate normal Earth gravity, while the other half was stowed in a static location, hence in weightlessness.

Moreover, each cassette was paired with a small camera unit that monitors the flies behavior and provides an artificial day/night cycle.

It was a very gratifying work, looking forward to the next feeding cycle!

Italian translation of this logbook entry: L+53: Astromoscerini spaziali, by Paolo Amoroso—AstronautiNEWS.

L+55

Samantha Cristoforetti, Elena Serova and Barry Wilmore in the 2014 Zero Robotics final on the ISS. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 55 (2015.01.17)—I know, I'm a bit late with the logbooks, but bear with me, I still want to bring you back to last week one more time, because last Friday we had a very special event on the Space Station: Butch, Elena and I had the pleasure and honor to [host in the Japanese Laboratory]() the finals of the 2014 Zero Robotics competition!

To participate in Zero Robotics, high school students need to write code that will control a SPHERES satellite – on Earth, of course, only in simulations, but for the teams that made it to the finals, their code actually controls one of the real SPHERES units we have on the Space Station.

SPHERES determine their position in space thanks to five beacons that we deploy in the JEM, thus defining the volume in which the satellites can operate. Small thrusters allow the SPHERES to move around and rotate as needed. Working gas for the thrusters is CO_2, coming from small tanks that we can quickly changes out when empty.

At the beginning of every run we set two satellites in a predetermined initial position and orientation and then let go, letting the code of the two competing teams take control. While watching mostly the SPHERES moving around the cabin, we could also keep an eye on the computer display showing the virtual environment in which the satellites were moving, which included an asteroid in the middle of the volume: the tasks for the satellites was to take pictures of this asteroid. But that was not enough: to actually gain points, they needed to point their antennas to Earth and transmit the pictures, all the while dodging solar flare by taking refuge in a safe zone behind the satellite, or else risk having their stored pictures corrupted or even the satellite (virtually) damaged if hit by a flare.

Video: [Expedition 42 - SPHERES competition]() (6:40)

Don’t think that writing good code was the only skill required here: Zero Robotics is very much a strategy game as well and it was fun to watch the different styles, some more cautious, some more aggressive.

Fuel management was a big concern as well: for each run a satellite had an allocated amount of CO_2, once that had been consumed they would not be able to fire the thrusters any more. Unless, that is, the satellites would start moving outside the allowed volume, in which case the code from MIT would take over and fire the thrusters to bring them back.

MIT runs Spheres and the ZeroRobotics competitions and most of the US finalists were gathered there watching the finals live, while most of the European finalists were at the ESA facility ESTEC in the Netherlands, including a team who came all the way from Russia!

And several more Russian finalists were gathered in Moscow.

Actually, after the initial stages of the competition last year, teams had to join forces in alliances of three: I believe all of the alliances included teams from the US and from Europe, which I thought was great.

For the record, the Zero Robotics 2014 champions are the LakeElevenVADARS, the alliance of Team Lake (US), Cora's Eleven (Italy) and VADARS (US). Heartfelt congratulations!

And to all who participated, we're very proud of you up here: for your enthusiasm and dedication in participating in a game that tested your skills, your creative thinking and your ability to work in a team even across continents. You guys rock. And for 2015… GO Zero Robotics!

Italian translation of this logbook entry: L+55: La competizione Zero Robotics: siete forti ragazzi!, by Paolo Amoroso—AstronautiNEWS.

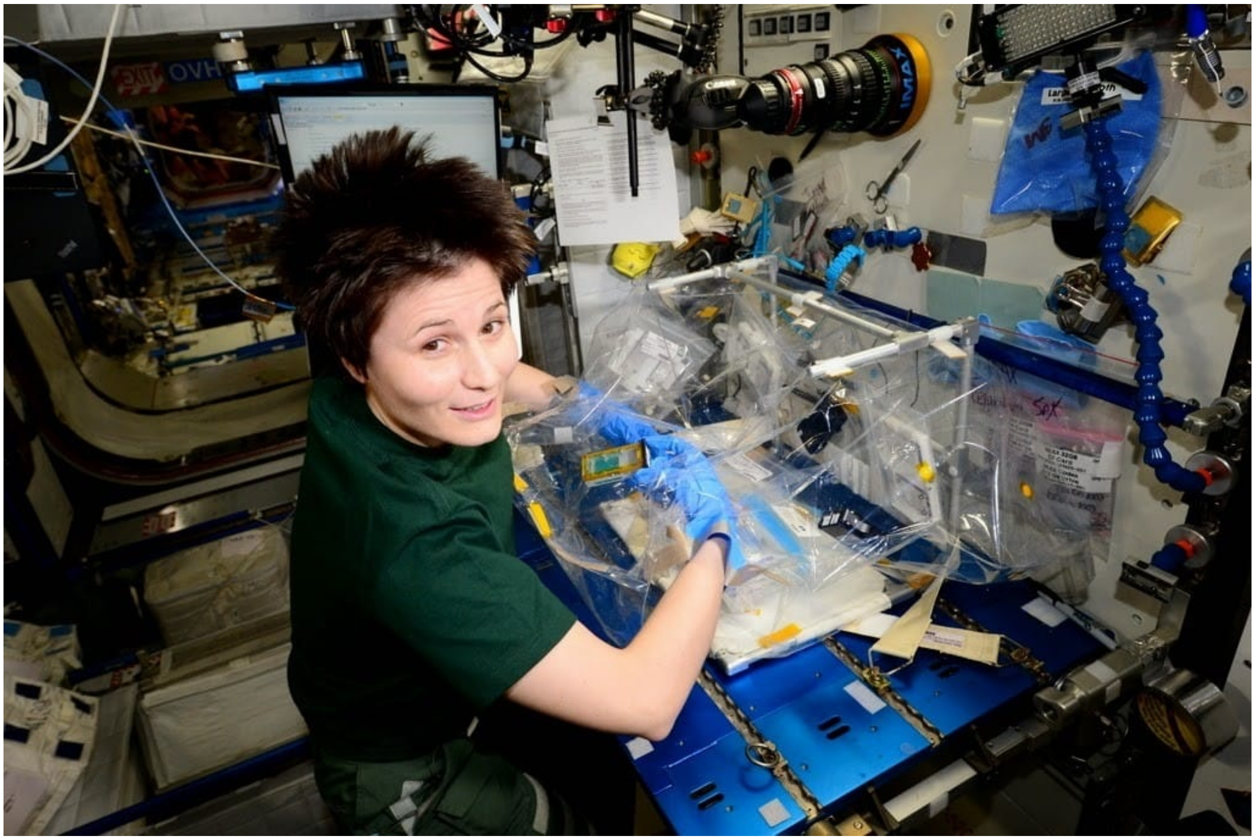
L+57, L+58

Samantha Cristoforetti wearing the sensors of the Drain Brain experiment. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 57 and 58 (2015.01.19-20)—This has been one of those weeks when the subject of the experiment is often… me.

Human physiology has definitely been very present on my science schedule, starting already on the weekend, when I got to do some data gathering while sleeping! In fact, Dragon has brought me a very fancy night wardrobe: a vest for the Wearable Monitoring experiment that I had to wear for two nights in a row for the first data gather. This vest has been custom-made for me and is a very tight fit, because it integrates instruments that need to be adherent to the body: electrodes, for a “classic” electrocardiogram, and a three-axis accelerometer to monitor the mechanics of the heart, namely the opening and closing of the heart valves. The hypothesis to be tested here is that tiny variations in the cardiac functions cause micro-awakenings that compromise sleep quality on ISS. Although I have to say, from a purely subjective and non-quantitative point of view of course, that I feel like I sleep great up here!

Early in the morning on Monday it was also time for the first session of Drain Brain. Actually, we already had an ultrasound session early on in the mission, but for this particular set of measurements we had to wait for the replacement hardware to be delivered on Dragon, following the loss of the Orbital-3 mission. Specific instruments for Drain Brain include three strain-gauge pletismoghraphs, which look like collars of a stretchable material, as you can see in the picture. They are actually sensors able to measure blood flow in the veins in a very simple and non-invasive manner, which is not dependent on the skills and interpretation of the operator, as is the case with ultrasound. While wearing these collars on my neck, arm and leg, I performed a series of breaths at 70% of my lung capacity, either remaining still or stretching and flexing my hand or my ankle. While doing that, I was breathing into our Pulmonary Function System and the software, via a graphic interface, was giving me instructions on when to start exhaling or inhaling. The main goal of the experiment is to study how the return of blood from the head to the heart changes in space, since we don’t have gravity effects helping with that. It’s something that we know little about for now and a better understanding of these circulatory mechanisms could potentially help in understanding some degenerative diseases of the brain.



Samantha Cristoforetti works on the Fruit Fly Lab experiment with fruit flies. Credit: ESA/NASA

After Drain Brain, I moved on to the second in-flight session of the Cardio Ox experiment, taking ultrasound images of the carotid and brachial arteries and Doppler measurements of blood flow. And to wrap up the human physiology day, I also did another data collection for Skin-B, that I have told you about before. And since many of these experiments need a matching sample collection, on Tuesday I performed a 24-hour urine sample collection and "Terry the Vampire" (a close friend of "Terry Scissorhands" the hairdresser) got do draw blood from me.

But hey, as you know, there's not only us humans on ISS! No, no, don't get excited, I'm not aware of any stow-away alien living onboard nor of any UFO flying combat air patrols in the area, but we have of course our friendly fruit flies! Some of the cassettes with fly and larvae did end up in the freezer at this point, but I put more cassettes in the centrifuge and static position of their dedicated facility and this multi-generation project is continuing on. For some of the fixation operations I got to build and use a disposable glovebox, as you can see in the picture: I didn't even know we had those onboard, the Space Station is always full of surprises!

Italian translation of this logbook entry: L+57, L+58: La lunga giornata della fisiologia umana, by Paolo Amoroso—AstronautiNEWS.

L+59 – L+65

Samantha Cristoforetti with the Epigenetic experiment. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days from 59 to 65 (2015.01.21-27)—Lots of experiments filling up my days this past week – sorry I didn't keep you updated much, but it's really busy up here on humanity's outpost in space!

Some experiments were old acquaintances, like "Circadian Rhythms", and several were new entries, like ESA's "Airway Monitoring". I talked about this latter pretty extensively in my training logbooks, like for example in L-129 Logbook.

For now, after some teething problems with the hardware (which is quite complex and partly used onboard for the first time), Terry and I got all the required data for the "normal" pressure session: in a few weeks we'll perform the reduced pressure measurement, for which we will lock ourselves up in the airlock and lower the pressure around us.

You know, I don't think that there any laboratory technicians on the planet who get to work on such a wide range of science as we do: I assume that all laboratories on Earth are more specialized and the scientists and technicians well trained on discipline-specific tasks! We, on the other hand, don't have refined skills and wide experience on any of the science activities we perform: in some cases we've had a training session many months ago, in other cases we get some training onboard, like videos or slides.

And of course some astronauts have a background in experimental science, but they are not the majority: most of us rely on very detailed procedures and, for the most complex operations, on real-time support from the ground by the experiment developers and/or the investigators. Sometimes they only talk to us via the regular communicators on duty in the control centers, like the Eurocom for ESA activities, while sometimes they are even enabled to talk to us directly on a space-to-ground channel, which in that case is dedicated only to them.

My own background in science is limited – what you get with an engineering degree – and if I had chosen an education in science, instead of engineering, it would have been physics, so even then I would have hardly had a chance to work with cell cultures and multi-generational experiments on fruit flies and worms. And I'm not sure that I would be cut for it as my full-time job – it probably requires more patience than I possess - but I do have a lot of fun working on these experiments here on ISS!

For example, on Monday I got to work again on the experiment "Epigenetics". My little friends in this case are not fruit flies, but another animal commonly used in research as a model for larger organisms: a millimeter-long worm called Caenorhabditis Elegans, for friends C. Elegans. And just like with the fruit flies, we want them to make babies: a total of four generations will grow onboard and specimen of each generation (adults and larvae) will be preserved in the freezer for return.

Dragon brought up the C.Elegans in starter syringes and I injected them into culture bags last week to start incubation. Then on Monday I extracted the babies using a special syringe equipped with a filter, that would not let the bigger adult worms go through. The first generation adults remained in the original culture bag and were frozen, while I inserted the second generation babies into another culture bag to let them further incubate. The purpose of the experiment, as the name suggests, is to study inherited epigenetic changes: that means changes in gene expression, but not in the DNA itself. Let’s put it this way: the environment cannot change the genes in your DNA, but it can affect how your genes are expressed, or “activated”. The worms will adapt to weightlessness and that will cause changes in their gene expression, so the question is: how, if at all, will these changes be inherited by the offspring?

Fascinating, isn’t it?

Italian translation of this logbook entry: L+59-L+65: I nuovi piccoli amici Caenorhabditis Elegans, by Paolo Amoroso—AstronautiNEWS.

L+66, L+67

ATV-5 and a Progress cargo in the orbital night photographed by Samantha Cristoforetti. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 66 and 67 (2015.01.28-29)—In the last logbook I've mentioned that the ISS is a very busy laboratory these days, with many experiments going on in parallel in multiple disciplines. At the same time, this is also a spaceport where spaceships full of goods come and go. And right now, we have two vehicles, Dragon and ATV, which are going to leave in the next couple of weeks and need to be readied for departure and reentry. So, for a couple days I have (mostly) doffed my virtual lab coat, I have rolled up my sleeves and gotten into cargo-packing-and-loading mode.

Loading a vehicle for reentry into the atmosphere is a delicate process: the overall mass and how this mass is distributed (hence the center of mass) need to be known quite precisely in order to properly calculate the reentry burns for the desired reentry trajectory. That is especially true for a vehicle that is recovered on Earth, like Dragon, but it's also extremely important for ATV5, because this ship will perform a special controlled reentry in the initial phases to gather data that will help prepare for Space

Station de-orbiting (when that time comes, which is not any time soon). I'm sure you'll be able to read everything about ATV5's so called "shallow reentry" on [the ATV blog]!

As you probably know, ATV is destroyed in the atmosphere, so we load it with trash: waste, packing material, old clothes and discarded items. And we are making sure that we fill it up to the maximum, because after the loss of the Orbital -3 mission on launch last October, the logistics onboard has become challenging: we have a lot of "stuff" (very technical space term), that was supposed to be long gone by now! Also for this reason, we are even putting a limited amount of trash into Dragon, although this vehicle is recovered intact on the ground (or more specifically in the ocean) and therefore its main job is to take return cargo back home.

But how does this all work, if the distribution of mass needs to be so precise? Well, actually I don't quite know. There is some miracle of planning and coordination happening on the ground and we receive two products onboard: a cargo list, that lists all the bags, their content, where to get them, where to put them and special packing instructions; and a choreography message, that tells you in which order to do the packing and, again, any special instructions (like taking pictures, reporting a serial number, packing an item in a particular direction). If there's any free space in the bags, we fill it up with filler foam that cargo goods were launched in and with ziplocs of old clothes. And then hopefully they will fit in their assigned stowage areas – which of course have a location code, so we always know exactly where each bag is supposed to go.

[Video: some moments of the ISS rotation maneuver on Wednesday, before the deboost]

Video: [Expedition 42 - ISS change of attitude on January 28, 2015](#) (1:40)

On Wednesday, as we were busy planning, flight controllers flipped the Station around 180 degrees – instead of flying with Node 2 forward, we ended up flying with the Russian Service Module leading the way. It was absolutely unnoticeable to me – in fact, I had forgotten about it. I would have noticed immediately if I had looked out of the Cupola, of course, but that was not possible, because the shutters had to be closed all day due to the series of maneuvers. Here's a new psychological disorder for you: Cupola Withdrawal Syndrome!

So, why did we fly "backwards" on Wednesday? Well, we had to point the thrusters of ATV forward, so that they could be fired to brake the Station just a little bit, enough to lower the apogee (the higher part of the orbit) by a couple of km. We typically use ATV to do just the opposite – raise the orbit periodically, with a so-called reboost – but this time a "deboost" was necessary to make our orbit just right for the next Progress vehicle coming up.

The deboost lasted about 4 min: I floated still in the US Lab and I let myself being propelled to the other side of the module as ATV was pushing the Station around me. It was fun!

Italian translation of this logbook entry: L+66, L+67: Cargo in partenza e arrivo allo spazioporto ISS, by Paolo Amoroso—AstronautiNEWS.

L+68 – L+71

Samantha Cristoforetti replaces a waste urine recycling tank. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days from 68 to 71 (2015.01.30–2015.02.02)—Well, here we are. Ten weeks have passed already: don't know what's going on up here, but time is going by way too fast!

On Friday I had another date with our space worms, the C. Elegans, as I wrapped up the week with a session of the experiment Epigenetics: I separated again baby worms and adult worms, as I wrote about [in a recent logbook](), so now we have the third generation growing in the incubator, half of the samples in weightlessness and the other half in the 1G centrifuge.

I also took care of the Columbus internal cooling system last Friday. As you know, we use water to remove heat from equipment (via cold plates) and from the cabin (via the air conditioning system) and periodically we need to add the antimicrobial agent OPA to the water to make sure we don't have any microbial growth in the lines. Actually, Terry did most of the work last week: I was only tasked on Friday to get a water sample after the OPA had been added. That water will return to Earth and be analyzed on the ground to check that we have indeed the desired OPA concentration.

Samantha Cristoforetti in the Dome with the Intercultura t-shirt. Credit: ESA/NASA

On Saturday morning I usually sleep in – I'm a night owl, not an early riser – but this time I was up at 8 for a very special appointment. I got to talk on the HAM radio with students in Italy for a pass of about 10 minutes: the pupils of the institute "G. Bearzi" in Udine (hello!) and a very special group of young men and women from all over the world who are just starting their exchange semester in Italian schools thanks to the non-profit Intercultura or, internationally, AFS. I was myself an Intercultura-AFS exchange student, spending a school year in the US, while my crewmate Terry spent a summer in Finland! And to all the exchange students on the planet who will read this: I am proud of you, I hope that you'll enjoy your adventure, that you'll smile through the difficult times (they will come) and that you'll recognize that this is a great gift and it brings with it responsibility. And I'm extremely grateful to the families who make this all possible by hosting an exchange student: thank you for your generosity, you rock!

OK – back to more down to Earth topics, so to speak: urine. Not very glamorous, I know, but it was at the center of my thoughts and my deeds for most of Monday. With ATV 5 scheduled to leave soon, a number of brine transfers into the ATV fluid tanks, now empty of potable water, were planned. Brine, as you might remember, is what is left over after recycling urine and it's final waste product. Transferring it to ATV takes care of our disposal need, at the same time is also helps with the mass and center of mass issues that I have talked about in a previous logbook.

In the picture, I'm swapping a recycle tank full of brine for an empty one. A big monster, isn't it?

Italian translation of this logbook entry: L+68-L+71: Un altro appuntamento con i nostri vermi spaziali, by Paolo Amoroso—AstronautiNEWS.

L+72, L+73

Samantha Cristoforetti with the vacuum connection tube of the vestibule Nodo 1-PMM. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days from 72 to 73 (2015.02.03-04)—Today is Saturday and, wow, this has been a busy week! Not so much time to keep you updated on our work and life up here, unfortunately. But hey, we can still catch up a little bit, so let’s see what’s happened on the ISS earlier in the week.

This past Tuesday I did something that we don’t quite do every day: I depressurized a part of the Space Station to vacuum. Not an airlock, those actually exist for that purpose.

A vestibule: that’s the small volume that is created when two ISS modules are joined together. Just like if in your home you had not one door between rooms, but two, with a little space between them which becomes a little “room” of its own if you close both doors. On ISS we call that little volume between hatches “vestibule”. Imagine you wanted to make sure that both those hatches do not leak – the best way to do this leak check is to depressurize the vestibule between them. If air gets into the vestibule, raising the pressure, there’s a leak in the hatch seals. Here is how it goes: you connect the vestibule volume to a vacuum access point and vent all the air overboard; then you measure the residual pressure, which will be very close to zero (in my case it was about 3 mm Hg) and then you wait 24 hours and check the pressure again. Of course, there is no such thing as a perfectly tight seal, some leakage will always occur.

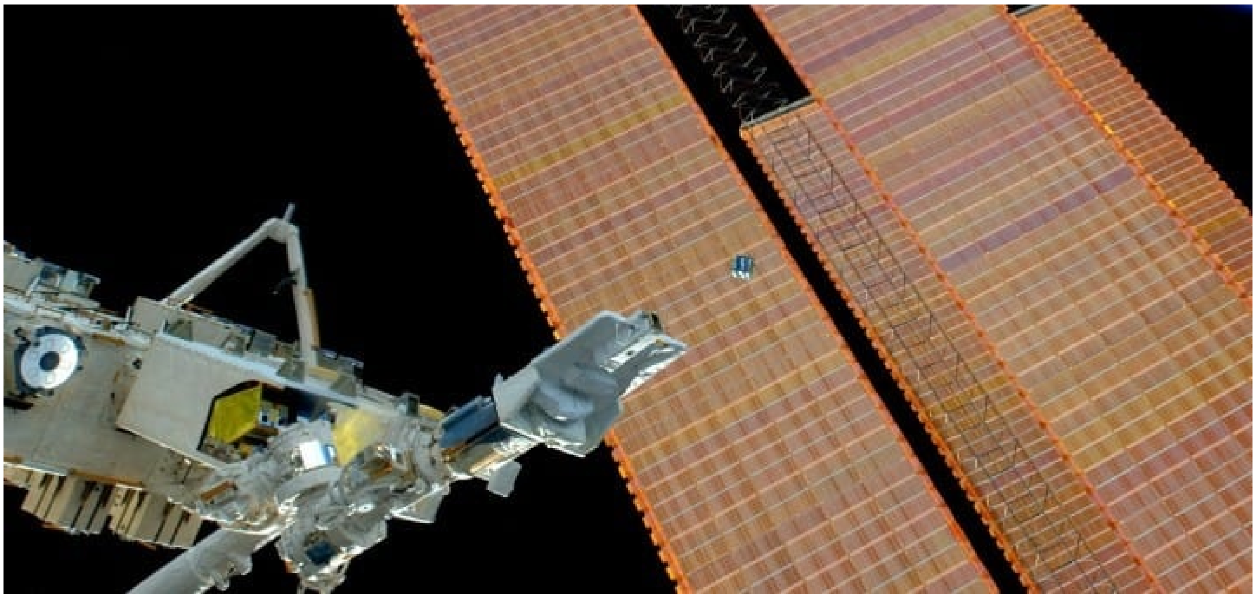
In the case of the vestibule, my procedure called it a good leak check if the increase in pressure in the vestibule after 24 hours was less than 5 mm Hg. I bet you’re curious by now… what hatches did we leak check and why? Well, I’m not sure if you’ve heard already, but we’re going to do some remodeling soon on the Space Station. Time to freshen up the room distribution a bit! Our PMM module, which is currently attached to Node 1 nadir, will be relocated to Node 3 forward and the Node 1 nadir port will get a luxury upgrade that will make it capable of receiving visiting vehicles. So we did the leak check on the vestibule between PMM and Node 1, to make sure that those hatches do not leak, because they will be exposed to vacuum when we do the relocation later this year. In addition, just before the leak check Terry and I installed a feedthrough: that’s something that allows a cable connection to go through a hole in the pressure shell – you plug the cable on one side, let’s say inside, and then you plug the continuation of the cable to the other side of the feedthrough, let’s say outside. The feedthrough is inserted in a hole and has seals to make sure air doesn’t leak out.

You’ll be happy to hear that the vestibule passed the leak check, so both the hatches and the newly installed feedthrough are in good shape. Good news, ah? By the way, what you see in the picture is the long jumper hose that we used to connect the vestibule to vacuum: it had to reach all the way across the Lab to the vacuum access point. Maybe it’s just me, but connecting something to vacuum is definitely something that commands attention: there’s nothing particularly complicated in the setup to depressurize the vestibule, but I did double-check and triple-check it before opening the equalization valve that actually vented the vestibule atmosphere into space. In fact, I even had a feeling for a moment that my ears were popping, which would be a sign of the pressure in the cabin dropping; but the pressure indications were stable, so it was probably the hissing sound from the ongoing venting playing tricks on my eardrums.

Wednesday was one of those “keep-the-Station-in-shape” kind of days for me. Besides tearing down the leak check setup, I worked for example on an a periodic environmental monitoring activity that checks our potable water for coliform and other microbial growth in samples from our potable water lines after 48 hours of incubation. Luckily, I could report zero microbial colonies on the microbial capture device and no magenta color in the coloform detection packet, indicating a negative result. Always good to have confirmation that our drinking water is safe!

Italian translation of this logbook entry: L+72, L+73: Il vuoto in una stanza, by Paolo Amoroso—AstronautiNEWS.

L+74, L+75



The release of a Cubesat from the Japanese ISS robotic arm during Expedition 42. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 74 e 75 (2015.02.05-06)—We have sent Dragon back home yesterday! I'll tell you more about this in the coming days, but for now, I'll just say this: looking back at the past weeks since Dragon arrival, it's very gratifying to think of all the work we've done, from the experiments to the loading and unloading operations, up to the last-minute transfer of cold samples from the coolers and freezers to cold bags for return. It's also nice to catch our breath today, though: since we had to work hard all weekend, we're getting this Wednesday off. A nice and welcome surprise!

But now let's go back to last week once more to catch up with the release of something a lot smaller from a somewhat smaller robotic arm: a tiny Cubesat, with the dimensions 10cm x 10cm x 10cm, was deployed by the Japanese arm on Friday. Pretty cool to see!

There were a lot of preparation activities the days before the release, in close cooperation with the JEM Control Center in Tsukuba, Japan. As you might remember if you've been reading this logbook, the JEM module has its own small airlock: we can open the door to the inside and slide a table into the cabin. The week prior to the release Butch had installed on this table the satellite deployment system with the Cubesat inside. On Thursday last week I got to depressurize the airlock. By the way, just like the big airlock for spacewalks, the Japanese airlock has provisions to recover most of the air into the Space Station volume: just the last bit of air, when the residual pressure in the airlock becomes too small (around 2 PSI), must necessarily be vented into space. Once the airlock was at vacuum, I opened the outer hatch into space and slid out the table with the satellite and deployment system. At that point, robotic controllers from Tsukuba grabbed the deployment system with the Japanese robotic arm and, once they had a firm grip, I got a GO to release it from the slide table, so that the arm could get full control of it and move it to the deployment position. My next task was to take pictures of the deployment and I have to say that this one made me a bit nervous: you only get one chance to get it right and that satellite goes away fast once it's released! Really didn't want to mess this up, can only imagine what a disappointment it would be for the students who developed the Cubesat not to have pictures.

Talking about students, on Wednesday I also got a chance to talk on the HAM radio to a group of school pupils from the schools "Locatelli-Oriani" and "Bachelet" in the Milan area: thanks for your great questions and you hard work preparing for this!

On Friday I got to spend quite a lot of time in our big airlock working on the EMU suits (the suits for spacewalks). In particular, I worked on the cooling water loops of both suits that will be used in the upcoming planned EVAs by Terry and Butch, "scrubbing" the water with different kinds of filters and adding iodine for microbial control. After that I took water samples that were returned on Dragon for analysis on the ground. The loop scrub can also be used as an opportunity to do some checks on the suits and get telemetry on the ground, so both suits were connected to a laptop on which we ran a data gathering application.

Hey, on Friday I also got to talk to Mission Control Moscow, which doesn't happen very often to us non-Russian crewmembers. As we get ready for ATV undocking this Saturday, I ran with Moscow a checkout procedure for the ATV remote control panel that we will have deployed in the Russian Service Module when ATV departs. We'll only need to send commands to ATV in case of an off-nominal situation, so I'm confident that we will not really need the control panel, but we'll be ready!

Italian translation of this logbook entry: L+74, L+75: Abbiamo rimandato a casa Dragon!, by Paolo Amoroso—AstronautiNEWS.

L+76 – L+79

The Dragon CRS-5 freighter just before being released from the ISS robotic arm. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days from 76 to 79 (2015.02.07-10)—It's been quite a historic day here on ISS: the last of the Automated Transfer Vehicles of the European Space Agency, ATV-5 George Lemaitre, has just departed and is now safely separated from the Station, on track for a destructive reentry into the atmosphere tomorrow: it's taking away tons of waste and discarded items, thus giving us quite a relief on ISS in terms stowage space.

But we'll have time to talk about the departure of ATV and all the pre-departure ops in a future logbook, today let's go back a few days and look at the departure of another vehicle earlier this week: Dragon! Last weekend was really busy here on Station as we got the last things ready to be loaded. I wrapped up the "Epigenetics" experiment on Saturday, fixating the last generation of our C. Elegans worms for return to Earth. Scientists on the ground took a look at the culture bags in the camera and reported that, judging from the color, the worms had been growing just fine, so hopefully there's now three generations of space-born

C.Elegans on Earth.

The weekend was also the time to reinstall in Dragon a number of cold-stowage facilities, called Polar and Glacier: these moveable fridges fly up and down powered by the Dragon power supply, but in between they are actually installed on Station. Moving them is quite time-critical, because we don't want them to remain unpowered for more than 30 minutes, so Terry and I worked together on a timed choreography that allowed us to operate in parallel, minimizing power-off time.

Last but not least, there was a last-minute entry on our timeline on Sunday morning: the removal of a fan-pump-separator (FPS) on a EMU, the suit for spacewalks. In L+16,L+17 Logbook I have told you about the FPS, since Butch and I replaced one back in December. Unfortunately, the FPS has failed on another suit. We don't currently have spares onboard, but it was decided that the failed one should be removed and returned on Dragon for analysis on the ground. Doing it the second time was not as daunting as the first time, especially since we did not install a new one, but it was still a challenging task to remove all the hard-to-reach, non-captive screws and washers! We were glad when we were done and could hand it over to Terry, so he could properly pack it for return.

Talking about packing, that was the big task for Monday. In the morning it was cold-stowage ops again, as Terry and I packed and loaded six cold bags with samples from our MELFI freezers. Cold bags are like coolers with a very thick insulation, in which samples for return are stowed together with cold bricks to keep them cool until they can be retrieved on Earth and put in an actual freezer again. For each cold bags we had diagrams which showed exactly how they had to be packed and, in some cases, in what precise orientation.

Unfortunately, that's one of those things that works a lot better with the help of gravity, because up here there's nothing to keep all those items where you put them, until of course the bag is full and the lid will press everything in place. Also, as you can imagine, packing cold bags is necessarily a last minute operation: we packed them on Monday morning and on Monday afternoon we closed the Dragon hatch. Terry and Butch then installed the controllers for the motors that drive the bolts keeping Dragon attached to ISS while I, In the meantime, took a trip to ATV to install the Break-Up Camera, which will actually observe the breakup of ATV from inside tomorrow!

Tuesday, of course, was release day. After a successful leak check of the hatches, making sure that neither Dragon nor ISS would have a leak when demated, Butch drove out the bolts, disconnecting Dragon from us, and then controllers on the ground started to fly the robotic arm to move Dragon to the release position.

In the early evening, Terry and I were ready at the robotic workstation in the Cupola to perform the release and send Dragon on its way home. At the release time, I ungrappled it and backed away the arm to a safe distance of about 4,5 meters. At that point, Terry sent the Depart command and Dragon performed its first burn, commencing a slow but clearly visible separation from ISS. Really strange to see it go, after having had it as our neighbor here in Node 2 for several weeks. But hey, we’ll get another one soon!

Italian translation of this logbook entry: L+76-L+79: La partenza di un vicino, by Paolo Amoroso—AstronautiNEWS.

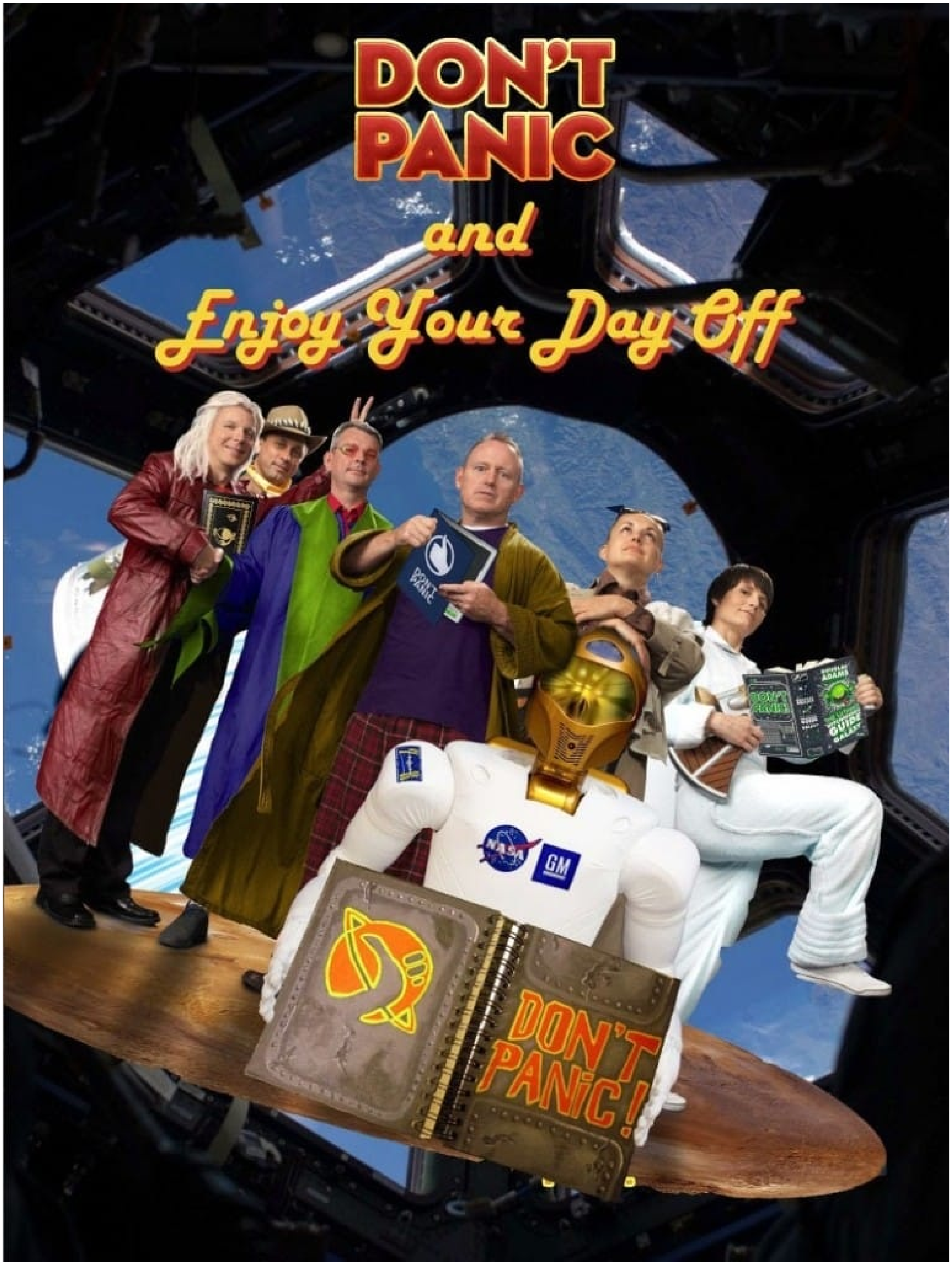
L+80 – L+82

Samantha Cristoforetti and Aleksandr Samokutyayev close the ATV-5 hatch. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days from 80 to 82 (2015.02.11-13)—After working on a tight schedule through the weekend to get Dragon ready for departure and then to release it on Tuesday, on Wednesday we were given a day off. Hurrah!

I'm a night owl, so I like to sleep in when I can. On Tuesday night, before going to bed, I took a last look at Wednesday's schedule for a confirmation that there was no need to set my alarm. Confirmed! So on Wednesday morning I slid my arms out of my sleeping bag around 9:30 and, as usual, opened my laptop to check the schedule and the Daily Summary, a message from ground controllers containing information about the state of the Station and any questions/answers/messages for the crew. Imagine my surprise when I saw an activity on the schedule at 7:30 in the morning. How could I possibly have missed that the night before? And weren't we supposed to have a day off? And how bad was it that I hadn't done it yet? But our Commander Butch is always up at 5 in the morning, so he would have woken me up if needed, right? So, don't panic, let’s see what this is about…

Now, take a look at the picture with a snapshot of that activity. I’ll let you be the judge: our ground teams have some sense of humor, don’t they? We did miss the reading session on that day, and I’m sorry to report that I did not find a Hitchhiker’s Guide to Galaxy in the indicated location, but we’ll make this happen somehow!


DON'T PANIC
and
Enjoy Your Day Off
DON'T PANIC!

An activity of the ISS Daily Summary on 11 February for the crew of Expedition 42. Credit: ESA/NASA

Thursday and Friday we were back to a normal work schedule. I got to be the operator for Butch on a number of eye exams, part of the Ocular Health research for which he is a subject: I supported his ultrasound, optical coherence tomography and fundoscope exams, taking images of his eyes in more ways than I would have ever imagined possible before ISS training. I'll also do the same exams this coming week, but I do them less frequently than Butch and Terry, because mine are a purely medical requirement, while my crewmates also serve as subject of this research effort focused on ocular health.

Then we had to get ready for ATV undocking.

Sasha and I had an On-Board-Training session on Thursday in which we reviewed all the pre-departure procedures and our monitoring tasks. Then on Friday we closed the hatches on ATV and ISS side and… you guessed it, I'm sure you know how these things work by now… we did a leak check.

We depressurized the vestibule between the hatches and then we monitored the pressure change for 30 minutes: had the pressure increased, either the ATV hatch or the ISS hatch would have been leaking air into the vestibule. Actually, Mission Control Moscow took care of the depressurization: vestibules on the Russian sides have a valve that can be commanded from the ground to vent the air to space. And our hatches passed the leak check with flying colors: up to 1 mm Hg of pressure increase is allowed and we only had a change of 0,5 mmHg.

That was it, the very last ATV was ready for undocking the next day!

Italian translation of this logbook entry: L+80-L+82: Niente panico, e godetevi il vostro giorno libero, by Paolo Amoroso—AstronautiNEWS.

L+100, L+101

Samantha Cristoforetti with the 100 days badge in space. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 100 e 101 (2015.03.03-04)—The Logbook is back!

Sorry for the very long Loss of Signal, it's been a busy time: three spacewalks in 8 days can really fill your days and I felt that I needed to focus on my task 100%.

Having to run several hours of airlock ops and get two crewmates "out the door" safely and as quickly as possible is something that commands attention: by far the most demanding thing I have done on orbit and, the first time, definitely somewhat stressful.

Spacewalks are usually covered quite in detail on the internet, so I'm sure you guys already know more than I could possibly tell you. And as far as my job as IV is concerned, if you're curious you can take a look at some training logbooks about Prep-and-Post classes, where we train airlock ops and pre-breath protocols. Check out for example L-70

Logbook.

Of course, some things are hard to practice on the ground. Take the SAFERs, for example, the jetpacks that are attached to the EMU suits for an emergency self-rescue in case of detachment from structure: on the ground we learn how to operate the latches that keep them secured to the suit, but it's a whole different story to actually handle suit and SAFER in space. Heavy, bulky things don't have weight up here, but they sure still have mass, hence inertia!

Anyway, everything went well, Butch and Terry did a stellar job outside, Anton was a precious help in the airlock and now we're all catching our breaths as we settle into a less hectic work pace.

Also, we're approaching fast the end of Expedition 42, which means that Butch, Sasha and Elena are getting ready for their fiery ride back to planet Earth next week.

Terry, Anton and I will be on our own up here for a couple of weeks, before Scott, Misha and Gennady join us towards the end of March.

Yesterday our soon-to-depart crewmates actually put on their Sokol suits for their pre-reentry leak checks and I have spotted Elena and Sasha practicing the Soyuz manual reentry on a simulator in the Service Module.

And we're getting return cargo ready: today, for example, I took water samples from all our potable water delivery stations and stowed them for return on Soyuz.

Preparations for the next crew's arrival have also begun. Yesterday I worked on stowing some cargo delivered on the Russian Progress resupply vehicle, which included Scott's clothes and hygiene items.

We have our little space wardrobe in Node 2, close to our sleeping cabins: each one of us has a big rigid bag with our personal clothing supplies, mostly organized in Ziplocs that cover two weeks each (we call those "bricks").

Butch, efficient as always, had already cleared his bag, so **Scott… if you happen to be reading… your clothes are already nicely organized in Node 2 overhead! Not sure that they are enough for a year, though: I bet you'll have more coming along the way.**

Hey, by the way, yesterday was our 100th day in space! Well, technically that's true only for me, since Terry and Anton had been in space before, but for sure it was our 100th day in space together. A bit scary, isn't it? Compared to the time behind us, the time we have left already looks little, only a couple of months left.

Of course there are things from my Earthling life that I miss – a shower being pretty high on the list – but it will be really hard to leave the Space Station. In the past 100 days I have gone from uncontainable excitement and constant discovery to familiarity and a sense of quiet affection for the Station itself, our crew and the teams on the ground spread all over the world with whom we interact every day. It feels like home and, by the way, a home in which you can float and that offers an unbeatable view out of the window!

Italian translation of this logbook entry: L+100, L+101: 100 giorni nello spazio!, by Paolo Amoroso—AstronautiNEWS.

L+129

Samantha Cristoforetti trains for manual piloting of the Soyuz. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 129 (2015.04.01)—As you’ve probably noticed, I haven’t been writing much this past month – my evenings have been just flying away, divided between the irresistible pull of the Cupola, other outreach projects and many little personal things that need to be taken care of.

During the day the Space Station keeps us really busy with science, maintenance, housekeeping, logistics and maintaining our proficiency in emergency responses, robotics, Soyuz flying…you name it. The variety of things we do up here is mind blowing, if I stop to think about it.

Oh, and by the way, we also had a Soyuz undock earlier this month, taking home half of our Space Station population. Well, at least in terms of human presence – I’m sure the microorganisms living up here, who outnumber us by orders of magnitude, would claim that it’s “their” Space Station and don’t care much if three biped mammals are replaced by three different ones. We, on the other, do care.

It was hard to see Sasha, Butch and Elena leave after being so close for four months and we did become just a little bit apprehensive when communication with their Soyuz was lost during the engine burn, which was somewhat unexpected. So we were happy to hear from Moscow that the search & rescue teams had made contact with the capsule and even happier to see our friends' smiling faces as they got their first breaths of fresh air in Kazakhstan.

In case you're wondering, we saw them on NASA TV, like many of you, I reckon. Not sure I mentioned before, but we can get a TV station transmitted live on one of our laptops when we have satellite coverage for the Ku-Band antennas.

For a couple of weeks the Space Station felt even bigger than usual, with Terry, Anton and I as the only (human) inhabitants. Not only were there fewer people around, but of course we were only getting half of the work done, so there was less com on space-to-ground. Overall, if felt a lot quieter. And now we're back to six!

Scott, Gennady and Misha have joined us last week and have added their personalities to the mix to create the new dynamic of Expedition 43. It's such an invaluable opportunity to be part of two different crews: in the end, it's the human interactions that determine our experience up here, so in a way it's like having two space missions instead of one. And if you have such awesome crewmates as I have had on Expedition 42 and have now on Expedition 43… well, life is good! Also, Terry and I have it really easy in terms of handover: Scott has already been up here for six months just 4 years ago, so he really doesn't need the amount of guidance and coaching (and patience!) that we required at the beginning from Butch. Scott is basically already autonomous and has already given some inputs that have improved our life and work. Always good to add a new perspective to the equation!

So, here we are, it's April 1st already and, barring changes, my Soyuz will undock on May 14th. With me onboard, unless I hide really well. I have only 42 days left on ISS, which is of course a cool number, but it's also not much. If I sound a little sad saying this, it's because I am.

Anyway, with so little time left I am committed to resume regular logbooks: there is so much still that I have to share with you! I thought I'd start by sharing some picture of life and work from the past four months: check out the captions for some insight. Talk to you soon!

ISS toilet maintenance


CAUTION
FIRE PORT
334

ISS toilet maintenance. Credit: ESA/NASA

Our solid waste container gets changed out when it's full, typically every 11/12 days. To easily keep track of how long it lasts, we write the day on it. On the wall of the toilet compartment you can see urine tubes and a urine collection bag: we draw urine from the bag into the tubes and then put the tubes in the freezer. When one of us has a 24-hour urine collection, the "equipment" Is typically deployed like that in the toilet cabin.

A MELFI freezer in the Destiny module

A MELFI freezer in the Destiny module. Credit: ESA/NASA

This is one of our MELFI freezers, where we keep samples like urine, blood or saliva, but also cold bricks that will prevent samples from getting too warm during the trip home. The drawers are typically kept at around -90C – gloves are a must!

On a work table in Node 2

On a work table in Node 2. Credit: ESA/NASA

We have two Maintenance Work Benches in Node 2. When not in use, they can be rotated flat against the wall. When we do maintenance on portable equipment, or even processing and analysis of water samples, this is a practical place to set up shop. Four crew quarters are just to my left in the picture: mine is in the deck.

The maintenance of an oxygen generator

The maintenance of an oxygen generator. Credit: ESA/NASA

Quite often, though, we do maintenance and inspection work on equipment without removing it from its installed location. This, for example, is the OGS, our Oxygen Generation System. It produces oxygen from electrolysis of water and injects it directly into the cabin.

With the NASA 3D printer in a glove box

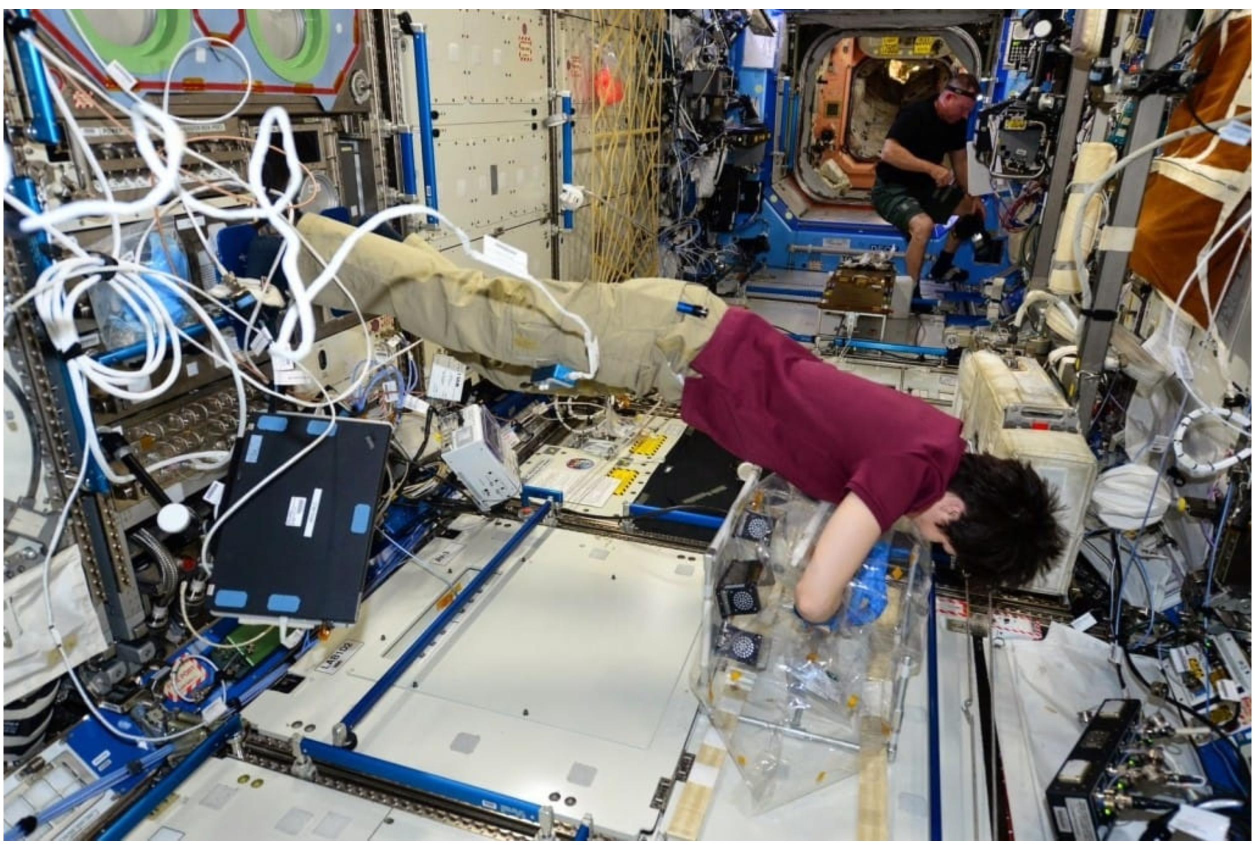

GLOVEBOX (MSG)
AV-3

With the NASA 3D printer in a glove box. Credit: ESA/NASA

We had a 3D printer up here earlier in Expedition 42. Print jobs were sent from the ground, we only had to remove the printed object and get the tray ready for the next run. That facility, the Microgravity Science Glovebox (MSG), has been used for other experiments in the meantime. You'll have to ask Terry about the details, though, he's been our MSG guy so far.

Samantha Cristoforetti with a portable glove box

Sometimes you don't need the big glovebox, a portable facility can suffice. This glovebox can be easily assembled when needed and then disassemble and stowed away.



Samantha Cristoforetti with a portable glove box. Credit: ESA/NASA

An ultrasound to the eye

An ultrasound to the eye

An ultrasound to the eye. Credit: ESA/NASA

Ocular health is a big thing on the Space Station. Adverse effects of microgravity on the eyes have been observed on many crewmembers and now the hunt is open for a full explanation. Periodic eye ultrasounds are part of that effort. Another crewmember serves as operator and a remote guider on the ground gives instructions based on the live ultrasound image and live downlink from the cabin camera pointed at the subject. Color-coded buttons are great for giving instructions to people like us, who have minimal training and experience.

At work with the JEM module airlock

At work with the JEM module airlock. Credit: ESA/NASA

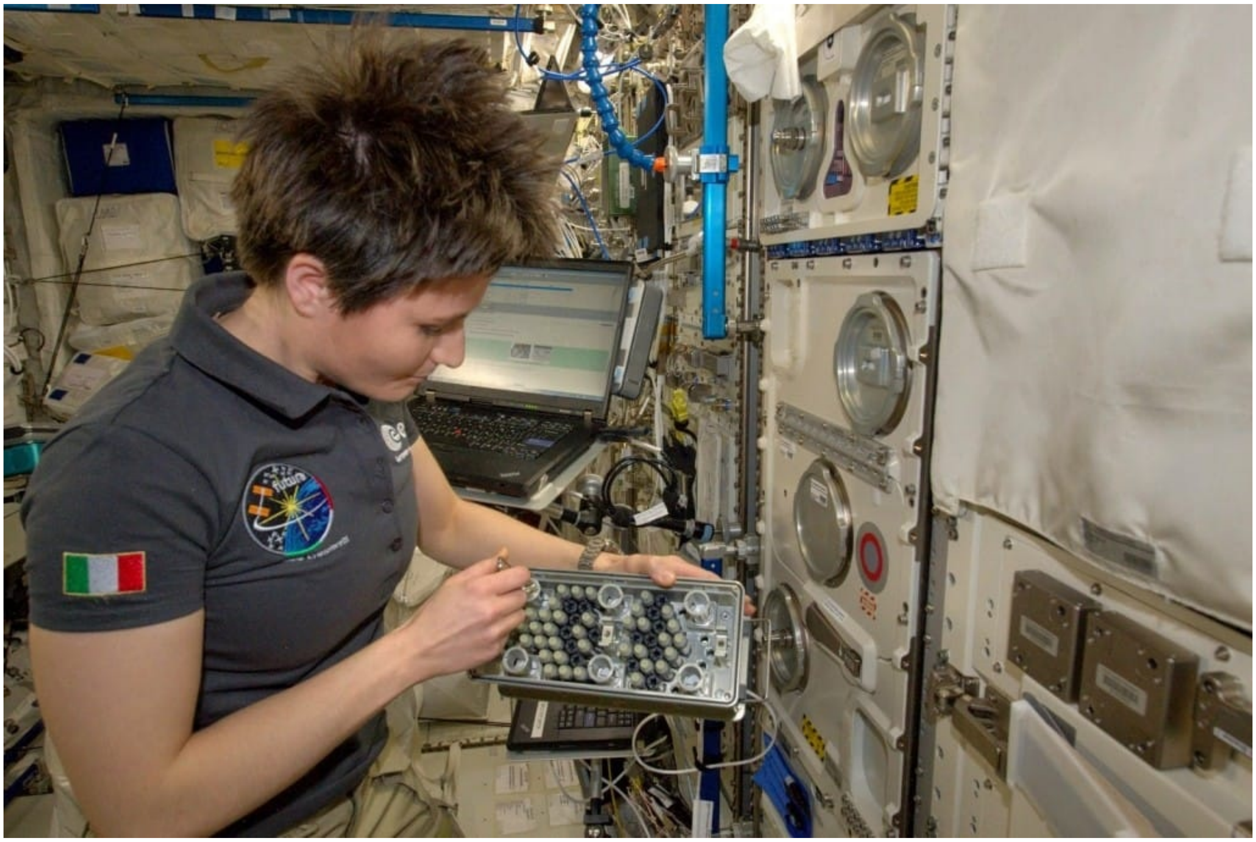
Once in a while we get to install hardware on the slide table of the JEM airlock, so that it can be transferred outside. Typically we have installed minisatellites encapsulated in their deployment system. In this case, I’m installing the Robotic Refueling Mission, a technology demonstrator for automatic refueling of satellites in orbit. A lot of delicate components to be handled with outmost respect! By the way, on the far right you can see a screen from WorldMap, the software we use for Earth observation. Show our flight path on the Earth's surface, pass predictions, and much more. The four green rectangles on the other laptops indicate the communications situation on our four space-to-ground channels for reception and transmission. Green indicates that all is well, the loss of signal is gray. That communications display can be called up on each of the PCS laptops, which are connected to the Station's control line and provide telemetry and command capability. Since in most cases the ground control remotely executes the commands, we keep almost all our PCS just like that, with the display of the communications situation open to full screen. They are strategically positioned so that there is one in sight wherever we are on the Station, so we can always check if we have or not communication with the earth.

The assembly of the MARES experiment

The assembly of the MARES experiment. Credit: ESA/NASA

Clear the cabin, we’re deploying MARES! This facility will support investigation into the effects of microgravity on muscles. It has had a few teething problems, but we had a successful checkout a couple of weeks ago. It was fun to assemble “the monster”, as we affectionately call it, and to run tests. The biggest challenge, however, was to make all the pieces fit again inside one rack volume after disassembly! Tetris, anyone?

With the samples of the TripleLux B experiment



With the samples of the TripleLux B experiment. Credit: ESA/NASA

TripleLux B is an ESA investigation into the effects of microgravity on immune cells, which takes place in the Biolab facility in Columbus. Biolab has required some unplanned maintenance work (a smoke detector quite deep in the belly of the rack had to be replaced) but luckily it was back in shape before the cell cultures expired. TripleLux B operations were successfully completed yesterday. Next up in Biolab is TripleLux A, with the cell cultures coming soon with SpX-6.

Training for manual piloting of the Soyuz

Training for manual piloting of the Soyuz. Credit: ESA/NASA

To drive home the point that we'll be heading home way too soon, recently Anton and I had an OBT (On-Board Training) on Soyuz manual descent. Just like in the simulator in Star City we got to fly manual reentry profiles: we just had to get used to pushing buttons on the laptop keyboard, instead of the big buttons of the real manual descent control device.

Group photo of the Expedition 42

Group photo of the Expedition 42. crew. Credit: ESA/NASA

We took a group picture of Expedition 42 before Sasha, Elena and Butch departed. Our motto: Don’t Panic and always know where your towel is!

Italian translation of this logbook entry: L+129: Mi rimangono solo 42 giorni sulla ISS!, by Paolo Amoroso—AstronautiNEWS.

L+130

Samantha Cristoforetti performs an OCT scan by Scott Kelly. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 130 (2015.04.02)—Hey, I'm sure you've heard: we have two new crewmembers here on ISS who will remain onboard for, no kidding, an entire year!

Might be the first of several extended expeditions and the main driver of course is the observation of human physiology and health during a longer period of the time than the standard 6-month missions, so it's not surprising that Scott and Misha are already being put "under the microscope" more extensively than, say, Terry or I.

There' s a wide range of investigations that will target numerous aspects of their adaptation process and all of those experiments need start-of-mission data.

Today was a big day of ocular health research! In fact, my working day ended with back-to-back sessions in which I supported Scott and Misha in taking funduscope images of their eyes, but even before our morning

Daily Planning Conference I was already tasked with the setup of our Optical Coherence Tomography (OCT) machine for their eye scans.

Gennady assisted Misha, before it was my turn to assist Scott. I must confess that I dread these events a little bit: getting good scans is not always easy and it's not uncommon to have to repeat them multiple times to get a satisfactory result. It can be somewhat frustrating for the operator and tiring for the subject, who has to keep his/her eyes open and still for a long time.

We have awesome remote guiders who run the show from the ground, but they get the image streamed from our laptop with an ever so slight delay that sometimes makes it difficult to give real-time guidance when the image changes fast. All that said, I really had nothing to worry about today. Scott is a natural at this! He is just the perfect subject (at least certainly much better than me): his gaze was so steady that only minimal adjustments of the lens position were needed during the scans to keep the proper eye layers in view, making my job so easy. Thanks, Scott!

Between eye research sessions and a few other small tasks (like troubleshooting one of our Merlin fridge), today I also had three videoconferences with people on the ground - a bit unusual, typically they are spread out in the week. Besides the weekly videoconference with my flight surgeon Brigitte, I got to talk to ESA folks at COL-CC and ESTEC: the mission director and lead flight director, as well as the Eurocom on duty and the mission science officer. Similarly, in the evening Scott, Terry and I had our weekly conference with Houston and Huntsville for the NASA perspective and update on current operations from the lead flight director and the rest of the Expedition 43 team.

If you are someone who follows the live-feed from the Space Station, including the space-to-ground communications, you might have noticed that you don't hear such conferences: that's because mission controls puts restrictions in place, so that nobody beyond the parties involved listens to the conversation. As you can imagine that's particularly important for the periodic medical and psychological conferences, but also for the weekly family conferences, as well as remote guidance for exams on human subjects, like an ultrasound or today's OCT scans.

I also got to work a little on water balance today. As I'm sure we know, [we recycle all the water onboard] thanks to a facility called Water Processing Assembly (WPA). Well, WPA has been having some hiccups lately, so it's not currently producing potable water. But… don't panic! We have plenty of water in the lines and plenty of full water bags. However, while the specialists on the ground develop a forward plan to troubleshoot WPA, there's a bit of work to be done to maintain proper water balance.

Check the picture captions for more info!

The controls of a bag of iodized water

The controls of a bag of iodized water. Credit: ESA/NASA

We keep water in these bags, called CWC-I. The letter "I" (and the color purple on the label) indicate that it contains iodinated water - iodine is added to our potable water for microbial control, but is eventually removed in the potable water dispenser before water is delivered to the end user (us).It’s important to have proper labels on the bags: brown labels, for example, indicate condensate (recuperated water before reprossessing). If you put the condensate in the "purple bag", that bag would be contaminated and you would no longer be able to keep drinking water.

A bag of iodized water. Credit: ESA/NASA

An OCT scan by Scott Kelly

An OCT scan by Scott Kelly. Credit: ESA/NASA

Scott and I working on his first scans with the Optical Coherence Tomograph. He will repeat these scans every month for the next year!

Italian translation of this logbook entry: L+130: Sotto la lente di ingrandimento per la scienza, by Paolo Amoroso—AstronautiNEWS.

L+131, L+132

Samantha Cristoforetti works on the Aniso Tubule experiment. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 131 and 132 (2015.04.03-04)—Yesterday was a relatively easy day, which is always kind of nice at the end of the week. Not that I didn’t have a full schedule - we always have activities from our morning Daily Planning Conference, or DPC, (somewhere around 7:30 in the morning) to our evening DPC (somewhere around 19:30). However, tasks can be more or less complex and more or less “routine”.

Running a new experiment that has not been performed before, which requires a complicated setup, a lot of coordination with the ground or delicate operations is of course a lot more demanding than performing tasks that I have done before and that I can perform autonomously – let’s say sampling the water or removing/installing lockers in our Express racks (modular racks that can support a variety of science operations and are continuously reconfigured depending on current and upcoming ops).

Simple or routine tasks that do not require a lot of support from the control centers are usually inserted in our schedule as “pink activities” – the writing is pink on our planning viewer, indicating that you can do them whenever you want, as long as they are done by the end of the day.

For non-pink activities, on the contrary, there is an expectation that they be performed more or less on time. Some tasks are even “blue-boxed” – a thick borderline around the activity on the viewer indicates that the time is to be strictly observed. Typical blue-boxed activities are live interviews with media or public calls with VIPs, which require a complex setup on the ground to provide audio and video connection with the party on the other side for the agreed time.

Most experiments are not blue-boxed, but they are also not pink. That’s because very often specialists very familiar with the experiment operations, and sometimes the principal investigator himself/herself, are available on space-to-ground for any assistance or real-time troubleshooting that might be required. In many cases, you don’t get a second chance to get an experiments right (at least not until you fly up new samples or equipment), so it’s important to have the maximum support available in case problems are encountered.

Talking about science, today I worked a little bit with the JAXA experiment ANISO tubule. I’ve performed several runs of this experiment, each one consisting (from my side) of a sequence of activities spread over multiple days.

At work on the Aniso Tubule experiment. Credit: ESA/NASA

Let's say that today is day 1: you retrieve a new sample chamber, like the one in the pictures, and with a syringe you slowly inject 1,5 ml of water. Then you put the chamber in MELFI for 96 hours at +2C! This simulates winter and promotes good germination of the Arabidopsis seeds. Then the chamber is moved to ambient temperature for about 4 more days (spring has arrived!) and finally, after adding more water, two days of observation in the fluorescence microscope begin, with scientists on the ground directly studying live images from ISS.

We have known for a long time that plants grow differently in weightlessness. Since they don't "feel" gravity up here, they tend to grow a thinner and longer stem. In fact, the ANISO scientists have even done the opposite on the ground, putting seeds in a centrifuge and showing that in "hypergravity" they grow shorter and thicker stems. The difference is likely due to different orientation of microtubules in the individual cells that change their shape. I find it fascinating that something as small as a cell would be affected by gravity, but it is!

A particular group of proteins, called MAPs, control the orientation of the microtubules and hence the shape of the stem. Now, you can’t really see microtubules and MAPs directly in the fluorescence microscope, but these Arabidopsis plants have been engineered in such a way that they also produce a fluorescent protein that accurately mimic MAPs: and that does the trick! Now you can use the fluorescence microscope to indirectly observe proteins that you otherwise would not see. Fascinating, isn’t it?

Sounds a bit paradoxical, but microgravity is really a great place to study gravity response of plants, which in turn can help optimizing agricultural practices. I don’t have a background in life sciences, so this is all very new to me, but I hope you find it as intriguing as I do!

Italian translation of this logbook entry: L+131, L+132: In microgravità per studiare gli effetti della gravità, by Paolo Amoroso—AstronautiNEWS.

L+133

The cone at the end of Columbus with bags to bring back to earth with Dragon SpX-6. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 133 (2015.04.05)—Quiet Easter Sunday here on ISS, no work at all on my schedule, although I did a little bit of work off the “task list”. Oh, I don’t think I ever told you about the task list, time to change that!

The task list is a pool of activities that have been prepared by the ground, but don’t have a high enough priority to be put on the regular schedule. If we want to do some work in our free time, or if time frees up because some activity could be completed quicker than expected, or because a planned activity was aborted, we can browse the task list and find useful things to do.

Some are bigger tasks of several hours, others are little housekeeping tasks, like replacing the batteries or the shell of a laptop, or reconfiguring stowage in preparation of an upcoming activity. Packing and unpacking a cargo vehicle is also often on the task list, in case we want to work ahead during our free time.

And since being late with packing is really not an option, we always get a head start: the stowage specialists on the ground send up pre-pack gather lists well before a vehicle actually shows up, so we can start getting return bags ready. In the picture you can see the Node 2 endcone with all the bags we already started to pack for Dragon. Compare it with the way it looks about a month ago for our Exp 42 crew picture!

The crew of Expedition 42. Credit: ESA/NASA

Recording video messages or educational videos for outreach purposes is also typically on the task list, as well as a couple of procedures that are permanent entries: changing the solid waste container and the urine container in our space toilet. After the first couple of times, you don't really need a procedure for that, but an activity also has a stowage note attached, which in this case tells you which new containers to get, where to find them and where to stow the removed ones.

As you know, every item is tracked on the Space Station: by part number, barcode , serial number… or all three of them!

Things still get lost occasionally, unfortunately. We're all humans and as such are prone to making mistakes: if something ends up in the wrong place (in the real world or in the inventory system), who knows when it's going to be found! Also, things accumulate over time that should actually have been disposed of a long time ago. Not unlike most people's homes, we can't afford to accumulate things that are no longer necessary, because we need the space for new hardware to support the science program.

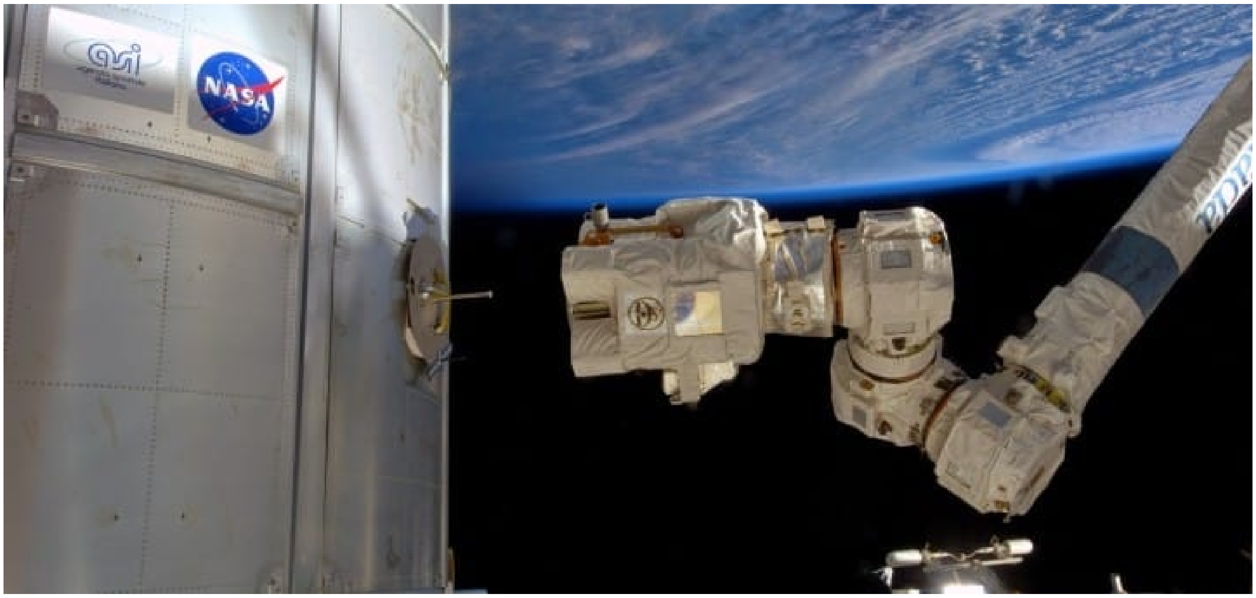
The European laboratory Columbus, after having been on orbit for about 7 years now, has seen a little bit of that. When I arrived back in November there were quite a few stowage bags on the rack fronts: so much science going on, so little space to stow the equipment! Luckily ATV5 and SpX-5 took away some bags that were no longer used and some optimization of the available volume in the endcone has cleaned up the cabin quite a bit.

In order to optimize more, on the weekends I have been doing photo-audits of our main stowage rack in Columbus, the Deck 4 rack. The stowage team at COL-CC, the COSMOs, want to have the full picture of what's in those lockers, in order to devise a consolidation plan that will hopefully save some space! So I have been snapping away… patiently, locker by locker, bag by bag, item by item, nicely showing all the barcodes and serial numbers.

And you thought that being an astronaut was all glamour and adrenaline, didn't you?

Italian translation of this logbook entry: L+133: Non solo glamour e adrenalina, by Paolo Amoroso—AstronautiNEWS.

L+134, L+135



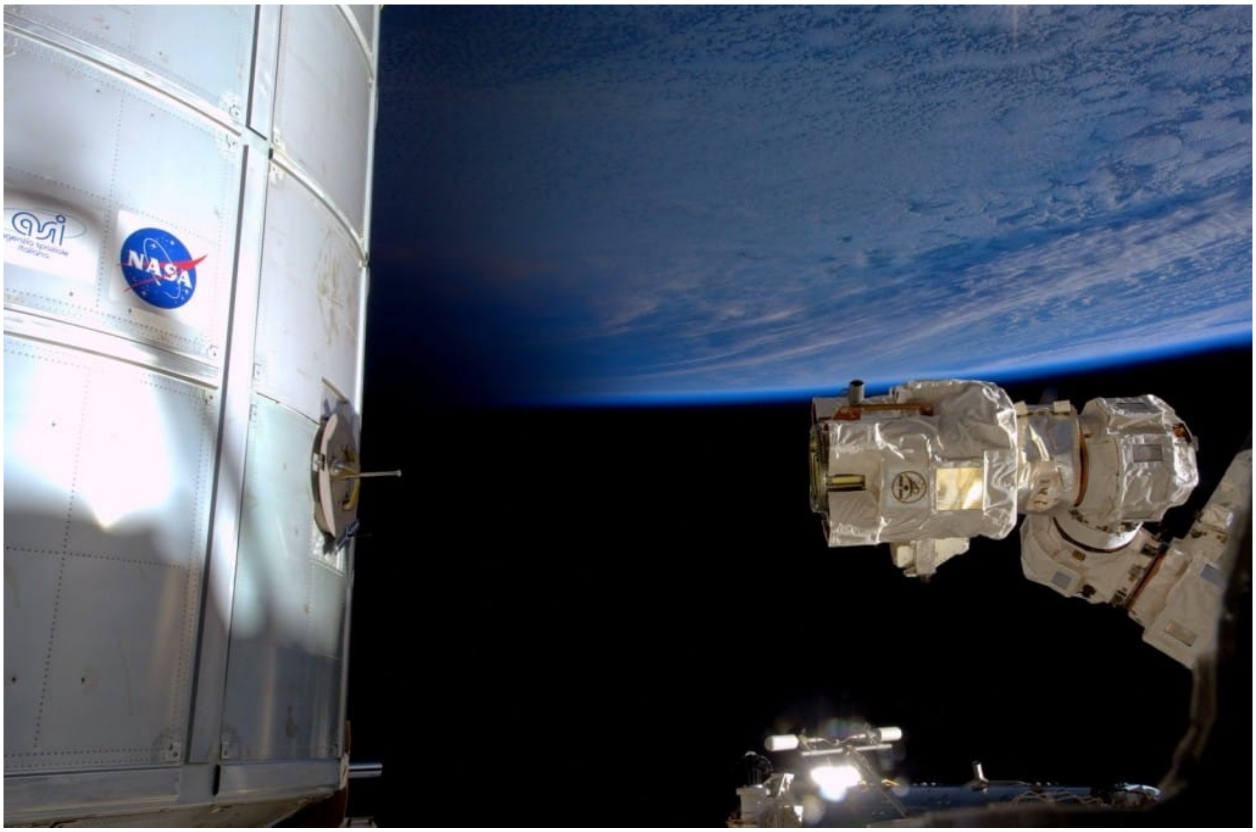
Un'esercitazione di cattura con il braccio robotico. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 134 and 135 (2015.04.06-07)—The arrival of the Dragon resupply vehicle is now less than a couple of weeks away and it’s amazing to watch the Station getting ready for it.

I wish I could say that I have the overall picture, but that’s up to people way smarter than me who sit in the control centers and run the show. Up here, we just try to do our best in performing our daily tasks, but these are of course all pieces of a puzzle that will eventually become a full visiting vehicle mission, from capture to release, with a significant complement of science to perform while Dragon is berthed to ISS.

Yesterday I installed new software on several laptops, so they will be ready to support new science. Today I spent two hours gathering from all over the Station into one single bag all the equipment required for a specific experiment, so that everything will be readily available when those operations start a few weeks from now. And of course Terry and I continue to prepare for the capture of Dragon.

Today was our “offset grapple” practice, a two-hour session in which we could practiced flying the real arm, instead of the simulator. I’ve talked about “offset grapples” in my L+20, +21 Logbook: check it out, in case you missed it!



Un'esercitazione di cattura con il braccio robotico. Credit: ESA/NASA

When the last Dragon arrived, Butch performed the actual capture. This time I will be the prime robotic operator, so I will be at the controls of the arm, while Terry will be responsible for communication with the ground, running the procedures and the malfunction cue cards (the latter will hopefully not be needed).

And speaking of malfunctions, on our last “almost-grapple” today we practiced the response to a “safing event” occurring the arm end effector is already over the pin, so very close to pressing the trigger to capture, or even shortly thereafter. The arm will automatically go into a safe mode following a malfunction, making it impossible to command the joints, the end effector or the arm in its entirety.

[Video, accelerated by 10X, shows the grip tests with the robotic arm of 2015.04.01]

Video: Expedition 43 - Testing the Canadarm 2 robotic arm (2:48)

Luckily, it's really 'two arms in one': granted, there is only one set of beams and joints, but there's otherwise full redundancy on all the components that allow the arm to function. In order to make use of that redundancy and complete the capture on the backup string, we would have to move from the Cupola to the Lab, where we have a second robotic workstation. On capture day, that second workstation is in a "hot backup" mode, meaning that literally one button press is sufficient to make it prime and put it in control of the arm. Wouldn't you love to have that kind of redundancy on your car when that red light appears?

Ah, yesterday I also spent some time on my periodic fitness assessment. We do that on our bike, CEVIS, once a month, using a dedicated protocol, while our electrocardiogram is recorded and blood pressure is measured every five minutes. Based on this data, specialists on the ground can make an estimation of our VO_2max, which is a commonly used measure of cardiovascular fitness. The typical trend observed in 6-month missions is a significant, quick decrease of VO_2max early on and then a slow recovery through the daily workouts on bike and treadmill. And the closer we are to returning to Earth, the more critical it is to exercise, to be ready to face gravity again.

Italian translation of this logbook entry: [L+134, L+135: Ai comandi per la cattura del prossimo Dragon](), by Paolo Amoroso—AstronautiNEWS.

L+141 – L+144

Samantha Cristoforetti works with the Columbus Modular Cultivation System. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days from 141 to 144 (2015.04.13-16)—Well, as you might have heard, Dragon's arrival has been delayed a few days. Had the launch occurred on Monday, it would already be berthed to Node 2 right now and we would already have opened the hatch and started to get urgent cargo out.

But hey, in the space business flexibility is paramount! The launch slipped by one day, delaying arrival to ISS by two days… that's orbital mechanics and phasing angles for you.

But if you think that we had two free days while waiting for Dragon to come knock at our door, I'm afraid you're not acquainted with the folks who run the ISS ops: they always have a slip plan! A launch is delayed? Voila', old plan is taken out, new plan is put in. Ready? Go! Yes, whenever things heavily depend on an inherently uncertain event like the launch of a rocket, mission managers, flight directors and planners always fully prepare two plans: that requires a lot of extra work on the ground, but it ensures that no precious crew time on ISS is wasted.

In this case they had pretty major plans in store for the case of launch slip. I kind of got that feeling on Tuesday already: when they give you one full hour to study a procedure you'll do the next day and then they give you another hour to gather hardware you will need for that procedure and then they tell you not to bother taking tools out of the toolbox, just take the entire drawer instead… when all that happens you start to think that you're going to get your hands dirty on some major work. Which I love!


FGB

“Don't choose, take the whole drawer”. Credit: ESA/NASA

While Terry and Scott were busy on their own major activity with the EVA suits, I spent the day in Node 3 reconfiguring the intermodule ventilation ducting in preparation of moving the PMM module later this year from Node 1 nadir to Node 3 forward. Basically, we need a way to get ventilation to PMM in its future new location. Never thought if would be possible to fit so many bags full of hardware in Node 3, in the pretty cramped space between ARED and the toilet cabin, but somehow it worked. And at 2 am Houston-time specialists on the ground were ready to support, with a ground model of the equipment to replicate any issues had we run into problems. Fortunately, with the exception of a couple of stuck fasteners , everything went smoothly: kudos to the team for having such a great, user-friendly procedure ready!

Dragon slip also carved some time to work on the European Modular Cultivation System in Columbus. I got to de-install a number of modules called Rotor Based Life Support Systems –self-contained boxes that are attached on the rotors of this facility. They will hitch a ride to Earth on Dragon and they will be refurbished and launched again in the future to support future plant experiments.

Ah, I also worked a little on a Kubik, the stand-alone centrifuge/incubators that we sometimes operate in Columbus for experiments on cell cultures. I wrapped up the experiment Stem Cells Differentiation by moving the experiment containers to cold stowage and downlinking Kubik data to the ground. As the name suggests, this experiment studies human mesenchymal stem cells, which can differentiate into several cell types to build bone, fat, cartilage, musles, tendons. Now, if you’re a stem cell and you have all this choice, how do you know into what you need to differentiate? What are going to be when you “grow up”? That depends on what kind of signals you get from so-called signaling molecules. Vitamin-D is one of those signaling molecules and in particular we know that it is involved in telling stem cells to turn into bone cells. Bone loss is a big issue in microgravity, as you know, so this experiment observes the effectiveness of the Vitamin D signaling by comparing stem cells differentiation in presence or absence of Vitamin D.

Pretty cool, ah?

By the way, not sure how much sunlight you get where you live (we don't get much up here), but if you haven't done so already and get a chance, at your next blood draw it can't hurt to check you Vitamin D levels!

Italian translation of this logbook entry: L+141-L+144: C'è sempre un piano alternativo, by Paolo Amoroso—AstronautiNEWS.

L+145 – L+147

Samantha Cristoforetti working on a Kubik centrifuge-incubator. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days from 145 to 147 (2015.04.17-19)—Well, the big news of the past few days is of course that Dragon has arrived! It's always very special to watch a vehicle approach Station.

As big as ISS is, this human outpost in space is only a tiny speck of metal in the vastness of Low Earth Orbit: and yet on Friday morning, as Terry and I monitored from the Cupola, a cargo ship from Earth found us and came knocking at our door.

I enjoyed watching Dragon getting bigger and bigger, as continents and oceans passed by beneath, but I also consciously tried to detach myself from the romantics of it all to remain focused on my main task ahead: operating the robotic arm to capture Dragon.

It's something I have practiced hundreds of times on the simulator, mostly with the virtual vehicle moving around a lot more than a real

Dragon usually does, but doing it for real is of course quite different: let's say that it's one of those situations when it doesn't take much to become very famous for all the wrong reasons!

Fortunately everything went well and, after capture, the ground team took control of the arm to slowly berth Dragon to Node 2 nadir – it's now basically an extra room just outside our crew quarters. On Friday I performed the vestibule leak check. As you might remember, the vestibule is that space between the berthed vehicle and the ISS, a little corridor that is formed when the two are joined. Before we open the hatch of ISS we need to make sure that the vestibule is not leaking, hence we pressurize a little, to ca. 260 mmHg, and then verify the pressure again after a certain interval of time. Vestibule passed the leak check, then Scott and I opened the ISS hatch and worked a couple of hours on getting the vestibule ready, mainly removing components that are not needed while Dragon is berthed and are in the way of… opening the Dragon hatch!

Scott and Terry opened the Dragon hatch yesterday morning and that was the beginning of a weekend of intense work, getting out urgent cargo and starting the science activities, many of which are on a very tight schedule due to degradation of samples as time passes.

As soon as the big bags were out of the Dragon center volume, my task was to retrieve a new Kubik, the stand-alone centrifuge-incubators I mentioned in the last logbook, and get it setup and configured to support two cell biology experiments, Cytospace and NATO, both of which started yesterday afternoon and will continue autonomously for a few days, when it will be time to remove the experiment containers from Kubik and put them in the freezer, waiting for return to Earth for analysis.

Cytospace, as the name suggests, looks at the cellular cytoskeleton, the structures within the cell that give it its shape. How does microgravity affect the shape of the cell? And, most importantly, how do changes in the cell shape affect gene expression? This sounds like a complicated concept, but in the end it simply means that the shape of the cell, which is changed by microgravity, likely affects the way the cell does its job. And we're really interested in understanding this better because… well, we’re made of cells and what happens in the cells determines what happens in our body as a whole. And vice versa, what we observe in entire systems of our body, for example in term of bone loss or impairment of the immune system, can be explained by changes at the level of the cell.

Next time I’ll talk to you about NATO!

Italian translation of this logbook entry: L+145-L+147: Arrivato Dragon possiamo iniziare gli esperimenti Cytospace e NATO, by Paolo Amoroso —AstronautiNEWS.

L+148

Samantha Cristoforetti injects the culture medium in the BRIC 21 experiment. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 148 (2015.04.20)—Busy day of science and logistics for me to start the week.

Dragon unpacking continues, yesterday I had one hour of transfer ops on my schedule. Looking at Dragon you may think we have made quite some progress already in the unpacking, but in reality we have cheated a bit. Many bags have been retrieved and temporarily stowed on ISS, so that we could access other cargo with urgent science. But of course, they won't unpack themselves… and some of them are huge, believe me. We call them MO bags and I could comfortably fit inside the smallest of them!

Today I also dealt with a special type of cargo, the Polar fridges. They need to be transferred to ISS, but since they are powered up inside Dragon and contain refrigerated goods and science samples, they need to be moved and reinstalled quickly, to minimize the time they remain unpowered.

Also today I had two science activities for the experiments BRIC 21 and Synthetic Muscle. BRIC stands for Biological Research in Canisters: you can see one the BRIC units in the picture.

This particular run investigates microbes and how they adapt to the space environment, with special attention to the development of antibiotic resistance. You've probably heard that this is quite a source of concern in healthcare these days and we really need to understand better how pathogens become resistance to antibiotics.

Doing research with pathogens on ISS carries some complications, because you need to provide the microbial culture with a growth medium: if the crew has to do this manually, as it's often the case, the operation has to happen in the glovebox to ensure containment of the hazardous microorganisms. Here's where BRICs come in handy: using a dedicated tool, as you can see in the photo, astronauts can push a piston and inject the necessary mediums without ever breaking the three levels of containment required by ISS safety standards. It's very quick and efficient!

But I bet you want to hear about Synthetic Muscle… well, turns out that Dragon brought us some samples of a special material that could be used to replicate muscle tissue. It's an electroactive polymer: you can make it contract and expand by applying different electric currents. It sure sounds a lot like muscle to me, doesn't it?

Applications on Earth are in the field of prosthetics, of course, but we're also testing how this material reacts when exposed to cosmic and solar radiation up here, because it could potentially be used in robots to enhance their mobility. Cool, ah?

Italian translation of this logbook entry: L+148: Nuovi affascinanti esperimenti: BRICS 21 e Synthetic Muscle, by Paolo Amoroso—AstronautiNEWS.

L+149

Samantha Cristoforetti works on the Osteo-4 experiment in a glove box. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 149 (2015.04.21)—Another day of science yesterday here on humanity's outpost in space!

First, you'll be happy to hear that the BRICs I talked to you about in the last logbook are happily chilling out at -98° Celsius in one of our MELFI freezers: after I activated the experiment on Monday, the microbial cultures remained at ambient temperature for about 24 hours and then it was time to put them in cold stowage, where they'll remain until they can be returned to Earth.

Yesterday I also performed the third and last run of the Osteo-4 experiment, which came up on Dragon last week. It's a set of three trays, each one hosting three bioreactors with a culture of mouse bone cells. The aim is to investigate the mechanism of mechano-transduction, which basically means that bones tissue "senses" mechanical forces and responds with a particular behavior. That's probably why we lose mass in space: in weightlessness there isn't much load on or skeleton, so the response of our body is to reduce bone mass. If we only could convince our body that we'll go back to Earth within a few months and all that bone mass will come in handy! To try and send that message we put mechanical stress on our bones by working out every day on a machine, ARED, that simulates weightlifting.

With the Osteo-4 experiment in a glove box. Credit: ESA/NASA

Anyway, back to our experiment, the point is to study gene expression in osteocytes in microgravity: that's because osteocytes, which are the most common cells in bone, are the mechanosensors of the bone; they are responsible for sensing mechanical loads and inducing appropriate biological responses. How this mechanism works, however, is still a bit of a mystery. Here comes Osteo-4 into play!

As for my contribution, my job was to remove the bioreactors from the trays they are installed in, to reconfigure the ducting to close all the loops and then put the bioreactors in cold stowage. What made it a bit more cumbersome than it otherwise would be is that, as you can see in the picture, I had to work in the disposable glovebox… my good old friend from the fruit flies experiment, remember?

Italian translation of this logbook entry: L+149: Capire come ingannare le ossa per migliorarne l'efficienza, by Paolo Amoroso—AstronautiNEWS.

L+150

Samantha Cristoforetti replaces the Urine Processing Assembly recycling tank. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 150 (2015.04.22)—Hey, I didn't forget that I promised to talk to you about the NATO experiment!

On Wednesday I wrapped up NATO by removing the experiment containers from the Kubik incubator and putting them into the MELFI freezer, their biological state being frozen until researchers on the ground can get hold of them and do their post-flight analysis.

The full name of the experiment is **Nanoparticles and Osteoporosis** and, like Osteo-4 from the last logbook, it studies the bone. But while Osteo-4 is interested in determining the mechanisms that make us loose bone mass in microgravity, NATO want to see what we can do about it and, in particular, if a particular type of nanoparticles could be effective in counteracting bone loss.

See, it's not very intuitive, but bone is a living tissue that is constantly destroyed and reformed. Cells called osteoclasts destroy bone, other cells called osteoblasts produce new bone. As long as destruction and production are in balance, everything is good, but in weightlessness this balance is disturbed and osteoclasts win. That's also what happens when people suffer of osteoporosis, unfortunately a common problem!

NATO observes in vitro the effects of adding to bone tissue various doses of "strontium-containing-hydroxyapatite-nanoparticles", or nHAP-Sr. Some ground studies have suggested that adding nHAP-Sr could be effective in impeding osteoclasts in their bone-destructing job, which would promote a more favorable balance in the bone destruction/production cycle. A promising research for us astronauts in space and for people on the ground suffering from bone loss!

But it's not science all the time up here of course. We do need to keep the Station up and running, which also means periodically changing the Recycle Tank in our Urine Processing Assembly, or UPA. You can see the UPA in the picture, it occupies the deck area beneath our space toilet. What's left of our urine after being processed in UPA, a dense greenish and not-so-pleasant-smelly liquid called brine, is collected in the recycle tank, which of course needs to be swapped when full.

But I did end the day with another cool new experiment called Nematode muscle. I'll tell you all about it next time!

Italian translation of this logbook entry: L+150: NATO, le nanoparticelle che contrastano la perdita ossea, by Paolo Amoroso—AstronautiNEWS.

L+151 – L+154

The cultures of C. Elagans of the Nematode Muscle experiment of Expedition 43. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days from 151 to 154 (2015.04.23-27)—After working on a number of new experiments early last week, on Thursday I spent most of my day working on cargo ops, mainly unpacking those gigantic bags that, as I mentioned earlier, we moved out of Dragon and temporarily stowed on Station while we unloaded urgent science.

You can never tell how long it will take to unpack a bag just by looking at the number of items it contains: even a few items can take a long time if the stowage locations are challenging. Let's say, for example, that you have to rotate a rack to get to a stowage compartment that is located in the aft, curved part of the rack, the one that lies against the cylindrical hull of a module.

Rotating a rack in itself is not complicated, but often you have to move stuff out of the way of the rotation path: bags, cables, computers, cameras… and then put them back once you are done. Imagine rotating part of your wall at home to access a secret room in the back, except that you have plenty of stuff attached to the wall and to the ceiling!

At work on fixing the first two cultures of C. Elegans: in one the larvae grow in microgravity, the second culture was placed in the centrifuge to simulate the gravity conditions of the Earth. Credit: ESA/NASA

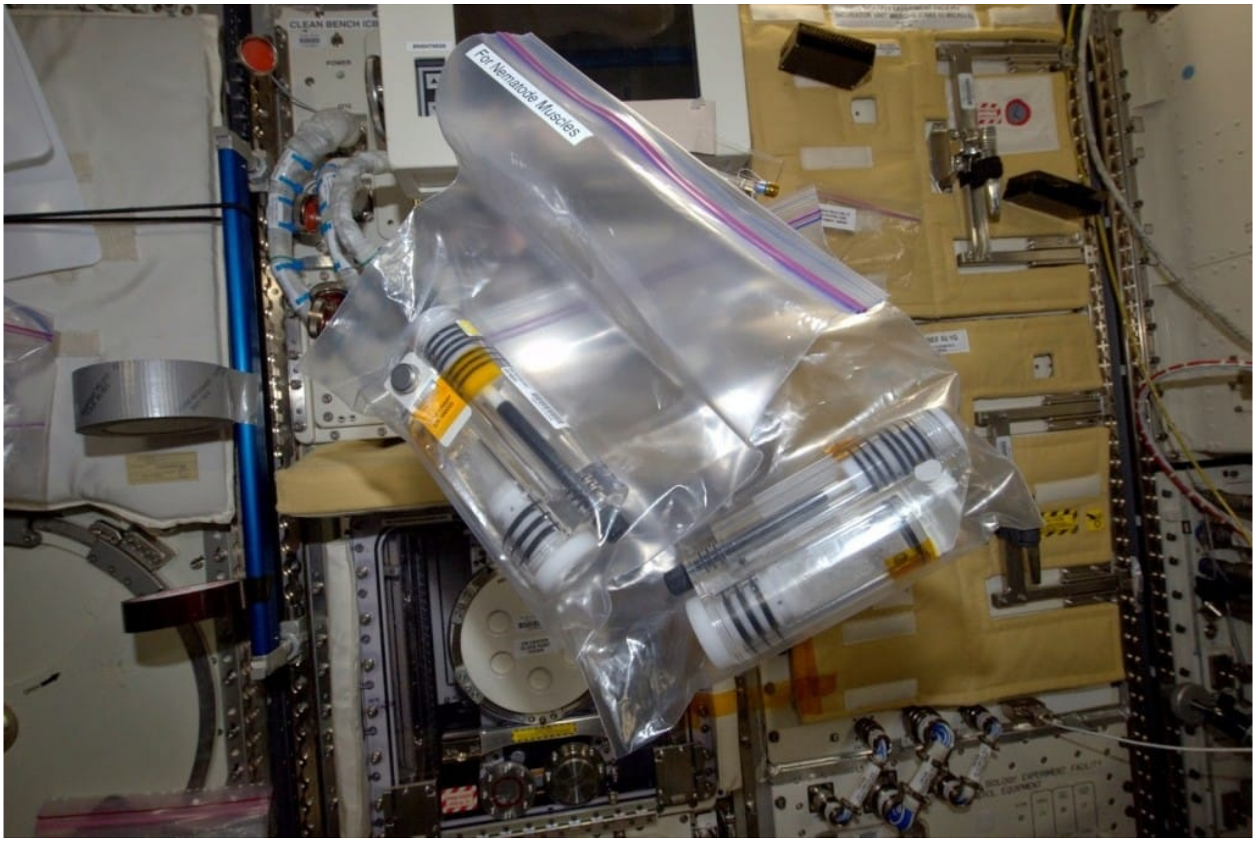
Anyway, I owe you some words about the Nematode muscle experiment I worked on last week. First of all, please welcome back to the International Space Station our good old friends, the C.Elegans. Yes, thanks to their very well understood genetic makeup, these tiny worms are a very popular model organism, on and off the planet! Remember the Epigenetics experiment?

But let's talk about this new experiment. As the name implies, it's about muscle, and specifically muscle atrophy. It's very clear by now that muscle atrophy is a consequence of spaceflight and it makes sense intuitively, but we don’t understand yet the basic biological mechanisms that lead to loss of muscle mass.

See, we astronauts can counteract these negative effects by working out every day, because we are healthy. But what about sick people who are bed-ridden? Understanding the molecular mechanisms that cause muscle atrophy could be useful in finding ways to help them!

Like so often in science, Nematode muscle is a follow-up experiment that builds on previous space research.

The team has already established a few years ago that if you fly C. Elegans to space they will have a reduced protein concentration in muscles and in the cytoskeleton (the “bones” of the cell). Also, quite interestingly, their metabolism will shift to an energy-saving mode. Now the question is: how do cells receive signals that induce those changes? How is the message conveyed? And, for those of you who are into biology, I’ll add that the insulin/IGF-1 signaling, in particular, will be investigated, so see if it can account alone for the metabolic changes. Or maybe, on the contrary, there’s more out there to find out about how cells “get the message”. Fascinating stuff!



The final product: two fastening tubes ready for cold storage at -98° C in our MELFI freezer! Credit: ESA/NASA

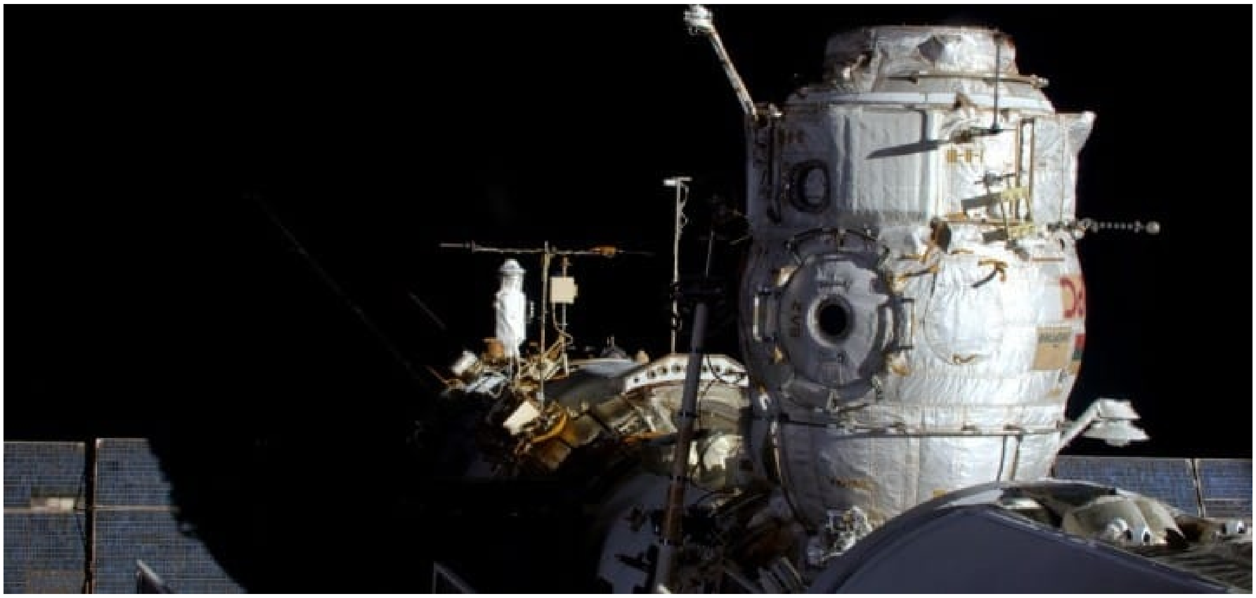
The weekend, by the way, was pretty quiet up here. We even got most of Friday off to recover from working two weeks straight, which was nice. Terry and I are heading home in just a couple of weeks and there's still a lot to be done to wrap up our Space Station life and get things ready to welcome the next inhabitants of our outpost in space.

P.S. Many **thanks to +Dmitry Meshkov** who is now translating this logbook in Russian, starting with the most recent ones.

And of course, **renewed thanks to the Italian, French, Spanish and German translators** of #SamLogbook for their continuing amazing work. You guys rock!

Italian translation of this logbook entry: L+151-L+154: Bentornato C. Elegans!, by Paolo Amoroso—AstronautiNEWS.

L+155, L+156



The docking port of the Pirs module remained free due to the non-arrival of the Progress M-27M / 59P. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 155 and 156 (2015.04.27-28)—Another week has gone by on ISS, one of my last on board. Time sure flies when you're having fun!

Well, the biggest news of this past week, as I'm sure you've heard, is that the Russian resupply vehicle Progress 59P didn't make it to ISS.

On Tuesday morning we received a call from Houston saying that Mission Control - Moscow had downmoded the mission profile to a two-day rendezvous, as opposed to the standard 6-hour profile that would have had Progress dock to ISS by early afternoon.

Of course, there's a lot of minor issues that can force a transition to a 2-day profile, so at that point we still expected to see Progress pull up in its parking spot by Thursday. We know now that 59P will never make it to ISS. Mission controllers in Moscow have valiantly tried all they could with the available telemetry and commanding capability, but unfortunately all efforts to recover the resupply mission have been unsuccessful.

The focus of the community has now shifted from the recovery attempts to analyzing the mishap and finding the cause. We'll know more once our Russian colleagues will have concluded the investigation which, inevitably, will take a while.

In the meantime, teams are assessing the impacts to the ISS program: what is the consumable situation? How about trash removal capability that has been lost? What are the implications for the next Soyuz launch and, consequently, the impacts on ISS activities?

As you can imagine, it's a complicated problem and, as is often the case, I'm happy that I'm just an astronaut and I'm only responsible for carrying out my tasks up here. People on the ground have a much tougher job, especially these days!

The good news is that **we're not going to run out of food, water, oxygen** or any other vital consumables any time soon – we have plenty on margin. On humanity's outpost in space no astronaut is going to bed hungry!

And we're busy as usual keeping the Space Station in shape, transferring cargo and, of course, doing science. On Tuesday, in particular, as the Progress story unfolded, I spent most of the day working on the final session of the Italian Space Agency experiment Drain Brain: ultrasound session in the morning, plus breathing sessions with the pletismographs morning and afternoon. If this doesn't ring a bell, you might have missed my L+57, L+58 Logbook, where I talked about Drain Brain!

Congratulations to the team on the completion of the experiment!

Italian translation of this logbook entry: L+155, L+156: Progress 59P non ce l'ha fatta, by Paolo Amoroso—AstronautiNEWS.

L+157, L+158

Samantha Cristoforetti among the material to bring back to earth with Dragon SpX-6. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 157 and 158 (2015.04.29-30)—Another weekend is over, only one left on the Space Station. The big event of the weekend of course was the **first espresso brewing**, which we can now even enjoy in 3D-printed zeroG cups… I'll tell you all about that in another logbook, I promise.

For now, I still have to catch up on last week's activities!

Wednesday was the day when we declared victory on Dragon unpack… and seamlessly moved on to the next fight: packing and loading!

As you might remember, we had done a little bit of pre-packing before Dragon even showed up, pre-staging bags with a nice green "SpX-6 Return" label and a unique number on the Node 2 forward endcone. Now it's time to fill up those bags with more return items and, of course, prepare many more bags.

It’s nice to be able to start loading things into Dragon. With both the newly arrived cargo and the cargo that will be returned stowed on ISS right now, the logistic situation can be challenging: in PMM, our main stowage modules, most rack fronts are covered with big bags secured with bungees, so getting things in and out of the actual stowage compartments takes some work and patience!

As for science, Wednesday and Thursday I worked mainly on the ongoing TripleLux-A experiment and on my last session of Cardio-Ox.

Cardio-Ox is the short version of the name, by the way. If you’re curious about the full name of the experiment, here it is: “Defining the Relationship Between Biomarkers of Oxidative and Inflammatory Stress and the Risk for Atherosclerosis in Astronauts During and After Long-duration Spaceflight.”

If you had the patience to read through the end, the name really says it all! It is reasonable to suppose that spaceflight, due to exposure to radiation, altered food intake, reduced physical activity and an overall stressful environment, may cause an increased level of oxidative stress and inflammation.

Both these undesirable conditions can be indirectly measured by determining the concentration of certain molecules in blood and urine: these molecules are the “biomarkers” in the experiment title. So, the first result of the experiment is to actually quantify oxidative stress and inflammation and for that purpose I have provided several blood and urine samples during the mission.

But the second part is: how do oxidative stress and inflammation correlate with the risk of atherosclerosis? To determine that, I have performed several remotely-guided ultrasound observations of my carotid and brachial arteries, looking for structural and functional changes that are considered good predictors of atherosclerosis risk. By the way, this is a long term study: the last post-flight session will be 5 years after flight.

Not sure I will still be writing logbooks at that point, but just in case, if you’re curious, look for that R+1825 entry!

Italian translation of this logbook entry: L+157, L+158: Rimane solo un week end sulla Stazione Spaziale, by Paolo Amoroso—AstronautiNEWS.

L+159, L+160

Samantha Cristoforetti with some laboratory equipment for human research. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission days 159 and 160 (2015.05.01-02)—Friday was one of those days when periodic bathroom visits are a bit more complicated than usual… it was time for another 24-hour urine collection, followed on Saturday morning by a blood draw, this time with “Scott the Vampire” who helped me fill up seven tubes of blood.

These collections were in support of the Cardio-Ox experiment, which I have talked about in the last logbook, as well as the “Biochemical Profile” and “Repository” projects of the Johnson Space Center.

These are not actual experiments, but rather aim at providing data that can potentially support a variety of research, both current and future, into the human adaptation to spaceflight.

“Biochemical Profile” tests urine and blood samples for a number of proteins and chemicals, which are known to be significant indicators of the metabolic state of the body (biomarkers): a database is created and data can be made available to researchers who request it to support their investigations.

“Repository” is a similar concept, but with an eye to the future. Urine and blood samples are collected and stored long-term under controlled conditions and will be made available in the future to researchers who make a solid scientific case for having them. In the future scientists will be able to test those samples with more advanced analysis methods and they might even be interested in biomarkers that are still unknown to us today!

I concluded my 24-hour urine collection with the first toilet visit on Saturday morning, but three hours after breakfast I did fill one more tube, together with a saliva sample, for the Italian experiment Bone Muscle Check, which aims at validating the analysis of saliva samples to quantify the reduction of bone and muscle mass. If reliable biomarkers can be found in saliva, one does not have to rely on much more invasive and time-consuming blood draws!

In the picture you can see some of our laboratory equipment for human research, including the urine collection bag. As you can imagine, peeing in a cup wouldn’t work very well up here. I remember testing a new female adapter on my very first parabolic flight almost exactly 5 years ago – in the cabin of the ZeroG aircraft, but inside a special tent!

I’ll also confess that I had some urine collection devices with me in Baikonur and I practiced with them before launch. In the end, there’s two things that you really want to be very familiar with when you’re about to launch to space: your spaceship and everything that has to do with using the toilet!

Italian translation of this logbook entry: L+159, L+160: Scott il Vampiro, by Paolo Amoroso—AstronautiNEWS.

L+170

Samantha Cristoforetti in Soyuz suit before the postponed return of the Soyuz TMA-15M. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 170 (2015.05.12)—Have you heard the news?

Today, Roscosmos, the Russian Space Agency, has officially announced that our landing is delayed until early June, which means that… Terry, Anton and I get to stay a few extra weeks in space!

As I'm writing this I just can't believe that our original landing date was tomorrow and I would now be about to jump in my ISS sleeping bag for the very last time. I suppose I wasn't mentally ready to leave quite yet, partly due for sure to the fact that this change of plans has been in the air for quite some time.

After the loss of Progress 59P two weeks ago, we all immediately realized that the next Soyuz launch would likely be delayed to buy time for a full investigation, implementation of any corrective actions deemed necessary and possibly the launch of another unmanned vehicle first.

Whether our return would be postponed as well was less clear: on the one hand there are obvious advantages in having a full crew complement onboard, on the other hand we had just lost a cargo resupply ship and consumables might have been an issue (turned out they aren't).

As we waited for the ISS partner agencies to make a decision, we were scheduled last week for all the activities required to keep us on track for a nominal landing: we performed a leak check of our Sokol pressure suits (leak check passed!); we fit checked our Kentavr compression shorts; we continued to pre-gather cargo for our Soyuz, including our personal 1,5 kg allocation and we packed our few other personal items for return to Earth on Dragon. Anton and I refreshed our manual reentry skills. Since a final decision about delaying our landing had not been made, we had to be ready.

However the Soyuz thrusters' test, which was scheduled early on Friday morning, was canceled and at that point it was clear that we weren't going home on May 13th. Ready and happy to stay!

And no worries: I still have underwear, socks and even one of my bonus food containers left. I'm really glad that I saved some of those basic supplies, just in case! I was also able to recover a couple of brand new T-shirts that I had already used to wrap some Dragon return items: they might have some glue residue from the gray tape on them, but they'll do the trick if I need them!

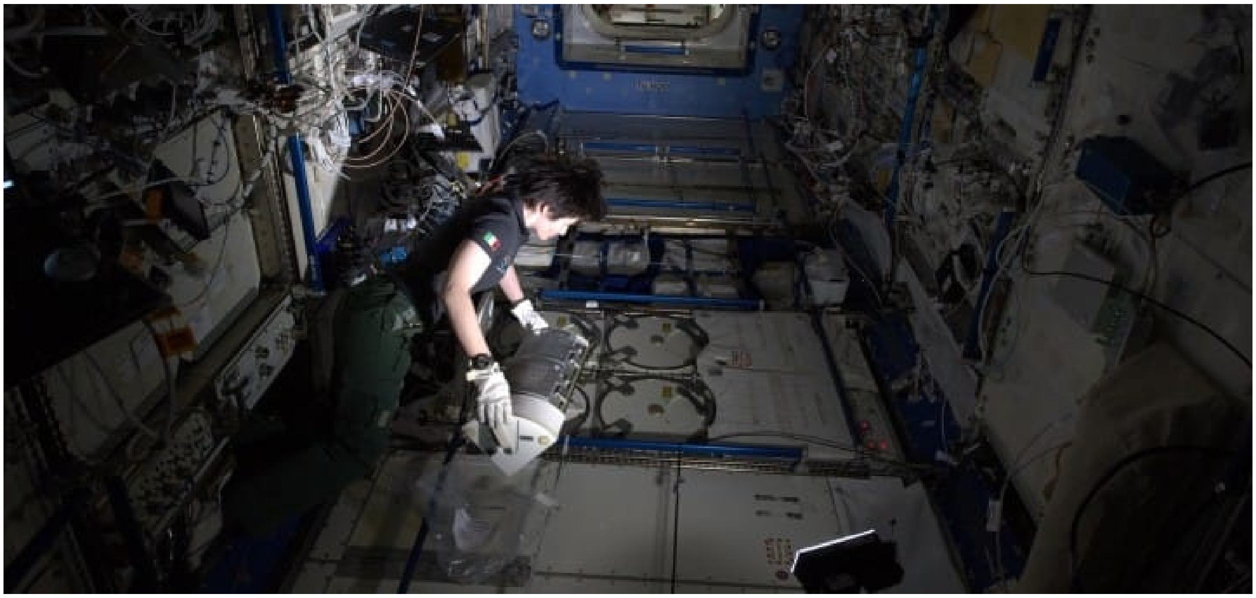
Talking about Dragon, looks like Terry and I will unexpectedly be around for the full SpaceX-6 mission: we're diligently packing and loading bags clearing space on ISS, which is always welcome.

We're also doing more preparatory work to move PMM to the Node 3 forward location and… who knows? The actual move might actually happen soon, instead of next summer. Since we're not going anywhere for a while, the planners will find ways to make good use of our time onboard.

And I would be thrilled about enjoying, even for a few days, a 360 degrees unrestricted view from the Cupola!

Italian translation of this logbook entry: [L+170: Sentita la notizia? Qualche altra settimana nello spazio!](), by Paolo Amoroso—AstronautiNEWS.

L+200/1



Samantha Cristoforetti takes the samples from the Stem Cell Differentiation experiment from the MELFI freezer. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit - Mission Day 200 (2015.06.11)—*After a summer of rehab and debriefs (and yes, 2 weeks of vacation), time to wrap up the story of my mission to ISS. This is the first entry in a final series of logbooks looking back at departure, landing and re-adaptation!*

Looks like this time they mean it: after a delay of one month, this time they really want us to go home.

It was an early wake-up for our very last day on ISS: the morning Daily Planning Conference, our tagup with the control centers to start the day, was scheduled for 1 am! But we did go to sleep in the early afternoon yesterday, in fact we have been sleep shifting for a couple of days. Undocking is not until 10:18 am, but there's a lot to do before we can send that command to open the hooks that keep our Soyuz attached to the Space Station. And if you're imagining us taking our time to say our mental farewell, leisurely savoring our last few hours in space…well, of course you're not, you know better than that!

In fact, the morning was busy as ever. Scott and I were in Columbus even before DPC, assisting each other with our blood draws. This was a so-called “ambient blood draw”, meaning that the tubes don’t go into the MELFI freezers, but return to Earth on the Soyuz instead. They will be retrieved from the descent modules right after we are extracted. The blood draw in itself was no different than any other we’ve done, but the packing instructions did look daunting, especially regarding some particular tubes that Scott uses for his Twin Study. I will be forever grateful to him for offering to taking care of all the packing on his own, so I could save some time for a final tour of the Space Station. Thanks Scott!

However, I did get my share of packing as well. Remember the Stem Cells Differentiation experiment from the L+141 - L+144 Logbook? Well, those samples need to go home today as well, so I got to retrieve them from MELFI and pack them in insulated pouches for return. There isn’t much space in the Soyuz descent module, as you can imagine, so we try to pack things as compact as possible. In case of early-retrieval items, we put the number of the package on a green label and we also take a picture, that will be made available to the retrieval team at the landing site, so they know exactly what to look for. Of course, Anton is loading the Soyuz exactly according to the cargo plan: having the center of mass in the right place is important in a space vehicle, especially if it’s your ride back to Earth!

By the way, it’s not only blood that I have been donating to science today. First thing after waking up for the last time in my floating sleeping bag, I took three different saliva samples – a 10-min routine that I have performed many times by now for the experiments Microbiome and Salivary markers. Oh, and don’t forget urine collection! I will be filling out urine tubes and putting them into the MELFI freezer at every void until hatch closure. The glamour of spaceflight…

Picture: retrieving the Stem Cell Differentiation samples from the MELFI freezer.

Logbook written on 2015.09.01.

Italian translation of this logbook entry: [L+200/1: Non siamo rimasti a goderci con comodo le ultime ore nello spazio](), by Paolo Amoroso—AstronautiNEWS.

L+200/2

Samantha Cristoforetti and the crew of the Soyuz TMA-15M greet the astronauts on the ISS before departure. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 200 (2015.06.11)—*This is the second entry in a final series of logbooks looking back at departure, landing and re-adaptation!*

In spite of the busy pre-departure schedule, I did find the time for one last tour of the Space Station: just a quick float-through, trying to soak it in and fix it all in my memory. Oh, and one flight last across the Lab, pushing off the handrails on the one end just the right way to fly straight to the other hatchway. Seems so natural, those clumsy first days when flying was a challenge are many month in the past.

I trashed my last toiletry items left in Node 3 and also a few last pieces of clothing left in my crew quarters from the night, after which I only "owned" the clothes I was wearing. I logged off my personal laptops: should anyone write an email to me in space from now on, I will never read it, since I will never have access to this email address again. I took one last look in Columbus, to make sure I was leaving it in good shape. Silly, in a way, I have no more formal responsibility for Columbus than for any other place on Station, but I guess I have always felt a bit in charge of this piece of Europe in space. Finally, I showed Scott where he could find my left-over bonus food. I ran out of olive oil a few days ago: I guess it's really time to leave.

At 6 am I joined Anton in the Soyuz for to perform a few checks and activation tasks. Everything went smoothly and quickly. Then it was time to stow some water and a last minute snacks in the orbital module of the Soyuz, verify that all the checklists were present and wait for [hatch closing time], around 7 am.

We had said our good byes last night, taking our time over dinner, but it was still an intense moment when we exchanged one last hug with Scott, Gennady and Misha. Even more so, when Anton and Gennady closed the hatches. For a moment I became acutely aware of the fact that life would continue on ISS, but we would no longer be part of it. But there was no time to linger on that thought, now we had to focus on getting safely back to Earth. The nice thing about spaceflight is that there is always a hatch closure to signal unambiguously that something has finished and it's time to focus on what's coming next.

First priority: get all the pre-departure operations done properly and in time, starting with the leak check of the Soyuz and Station hatches. As you can probably guess, if you've been following this logbook, to do that we needed to [depressurize the vestibule], the space between that two hatches. For safety (should the Soyuz external hatch actually leak) we all went to our place in the descent module and closed the hatch, to isolate ourselves from the orbital module. Then I sent the command to open the vestibule venting valve and we watched the pressure in the vestibule drop to almost zero. Although we were still solidly attached to the Space Station, there was now vacuum separating us from our friends inside. [cont.]

Logbook written on 2015.09.03.

Italian translation of this logbook entry: [L+200/2: Un ultimo sguardo alla Stazione Spaziale], by Paolo Amoroso—AstronautiNEWS.

L+200/3

Samantha Cristoforetti in Soyuz suit before the postponed return of the Soyuz TMA-15M. Credit: ESA/NASA

ISS Space Outpost. Earth Orbit—Mission Day 200 (2015.06.11)—*This is the third entry in a final series of logbooks looking back at departure, landing and re-adaptation!*

[cont.] After depressurizing the vestibule, we observed for a few minutes the pressure indications for the descent module and the orbital module of our Soyuz: both stable, so there was no obvious, fast leak. (Not that we were expecting one!).

Of course we needed to check for a slow leak as well, before we committed to leaving the Station and relying on the Soyuz hatch to keep our air inside. The full leak check would take 30 min, with measurements of the vestibule pressure recorded every 5 min, but since there was no fast pressure drop it was safe for us to reopen the hatch of the descent module and float back to the orbital module to don our Sokol suits.

I went first, as we had planned. Anton and Terry stayed in the descent module while I used the Soyuz toilet. I wanted to empty my bladder as late as possible: I did wear a diaper, but I wasn't sure I would be able to use it in the several hours of weightlessness that still lay between us and the deorbit burn. Somehow diapers and weightlessness don't get along for me, as I had experienced during ascent.

I put on my biomedical belt in direct contact with the skin and then my Sokol underwear, periodically calling the vestibule pressure readings from the manovacumeter to Anton and Terry, so they could report them to the ground. Over the course of 30 minutes, the maximum allowed pressure increase to call the hatches air tight was 1 mm Hg.

Anton joined me in the orbital module to help me don the Sokol. To make things faster, I basically held on to keep myself as still as possible and let Anton take care of tying and zipping up everything. One of the cool things about being an astronaut: you can let somebody else dress you as an adult and nobody laughs at you!

As Anton pointed out, we didn't have a whole lot of time. Because of a test of the Kurs antennas, which would run in the background during our undocking, the ground was going to send the activation command of the guidance and navigation system over an hour earlier than they normally would on a typical departure day schedule. We were already talking Moscow-time at that point, since this the time on which we run Soyuz ops: the night before we had diligently written the significant times in our checklists, based on the radiogram sent up by Mission Control Moscow. Not only vacuum separated us now from the Space Station but, in a way, also three hours!

After I was all dressed up in my Sokol, which would keep me alive in case of depressurization during re-entry, I took a last sip of water from a bag that would stay in the orbital module, grabbed one last snack and then floated to my seat in the descent module. It didn't escape me that those were my last few seconds of free floating: once strapped in in my seat, I wouldn't unstrap until after landing on Earth. [cont]

Photo: in the Sokol a few days before undocking for a preliminary leak check.

Logbook written on 2015.09.04.

Italian translation of this logbook entry: [L+200/3: Il bello di essere astronauta: farsi vestire da qualcun altro senza che nessuno rida](), by Paolo Amoroso—AstronautiNEWS.

L+200/4

Samantha Cristoforetti in the Soyuz TMA-15M during the launch. Credit: Roscosmos/NASA TV

ISS Space Outpost. Earth Orbit—Mission Day 200 (2015.06.11)—*This is the fourth entry in a final series of logbooks looking back at departure, landing and re-adaptation!*

Strapping in in the Soyuz is not as quick as fastening your seatbelt: the space is cramped, the position uncomfortable, some of the straps are hard to reach. Additionally, as I had learned during our Sokol leak check, being weightless doesn't make it any easier, since your body doesn't stay put in the seat. So I was glad when everything was done: oxygen and ventilation hoses attached, com and biomedical cables connected, shoulder, lap and knee straps fastened. I didn't tighten them, since it would still be several hours before the deorbit burn and our re-entry in the atmosphere. In spite of the physical effort of strapping in, I still didn't feel too warm in the Sokol, so I did not turn on the suit ventilation, enjoying a few more minutes of quietness.

Over the radio came the dear, familiar voice of our Soyuz instructor, Dima, who would be on space-to-ground from Moscow today, just like he had been our "control center voice" for hundreds of hours in the simulator back in Star City. He asked me for the status of our suit donning ops and I reported that I was strapped in and Anton was helping Terry in the orbital module. Then I selected the page on my command-and-control display showing the technical parameters of our vehicle. Everything looked good, except that our CO_2 level was trending high, close to 4 mm Hg. I was about to report it, but Mission Control Moscow was obviously watching it already via telemetry: Dima instructed me over the radio to activate our CO_2 scrubbing now, a bit earlier than it would have been foreseen in the checklist.

A few more pressure reports from Terry and Anton, which I relayed to Moscow, and the leak check was deemed complete and passed: undocking from the ISS was safe. By the way, I should add that we had also performed a check of the attitude thrusters a few days before undocking. First, the flight controllers had taken the ISS in drift mode, meaning that the Station would allow itself to be brought slightly out of attitude by the Soyuz thrusters firings, without actively trying to compensate for those disturbances. Then Anton and I had taken our seats in the Soyuz, we had configured Soyuz systems so that the manual controls would control thrusters firings and Anton had deflected the controllers in all six degrees of freedom in sequence, giving us a chance to make sure that they would react properly to all control inputs, both the in primary and backup control loop.

Back to the departure day, it was now Terry's turn to strap himself in the seat. Within a few minutes Anton also joined us in the descent module, closing the hatch that separated us from the orbital module.

Once we were all strapped in, we put on the gloves and closed the helmet to start the leak check of our suits. First we turned the blue regulator valve on our chests to the closed position and the simple ventilation flow from the fans blew up our suits just slightly. Then Anton gave a short 5-seconds countdown, at the end of which he started the stopwatch, as I simultaneously opened the valve that started an oxygen flow into our suits. We each monitored the increase of suit pressure on our wrist manometer and reported when we reached 0,1 atm and 3,5 atm, so that Anton could write down the “filling times”. The ground was also following along, since we had locked-in the transmit button before starting the leak check. After reaching 3.5 atm each of us let the suit deflate, controlling the flow rate with the regulator valve in order to give time to our ears to compensate for the pressure drop. Then we opened our helmet and I closed the supply line from the oxygen tanks. We would not remove the gloves any more until after landing.

Good news: all of our suits had “filled up” within the required time, passing the leak check. Another potential hurdle on our departure schedule was behind us!

Photo: from this screenshot from our launch video you can see how cramped it is in the Soyuz!

Logbook written on 2015.09.07.

Italian translation of this logbook entry: L+200/4: Non è facile come allacciare la cintura di sicurezza, by Paolo Amoroso—AstronautiNEWS.

L+200/5: Ganci aperti, lasciamo davvero la Stazione Spaziale!

The Soyuz TMA-15M with Samantha Cristoforetti on board moves away from the Space Station.

ISS Space Outpost. Earth Orbit—Mission Day 200 (2015.06.11)—[cont.] As you might have guessed, there was one last leak check to be performed before undocking: the leak check of the hatch between the descent module and the orbital module. Eventually, we would separate from the orbital module and the descent module hatch would be the one protecting us from vacuum!

Right now, of course, the pressure across the hatch was roughly equal: after all, we had just closed it a few minutes earlier. To perform a leak check, we had to create a pressure differential and to do that we would vent some air from the orbital module into space via the relief valve. Anton selected the closing command on his display, so that he would be able to reclose the valve with a simple button push. Once that was done, I opened the relief valve. On our life support display we watched the pressure in the orbital module drop, until Anton sent the command to close the valve. We had created a pressure differential of about 150 mm Hg and now we would check for any pressure equalization across the hatch: maximum acceptable pressure drop in the descent module was 25 mm Hg in 25 minutes. At the end of the monitoring time we were well within that requirement: leak check passed!

Finally, it was time to wait. Patiently. For almost an hour: a buffer time inserted in our timeline in case of problems. Let's imagine, for example, an issue with the suit leak check: we would have disconnected and reconnected the gloves, opened and reclosed the helmet, making really sure that no debris was caught in the sealing surface, and then we would have performed the leak check again. Or let's say that the descent module hatch would have failed the leak check: we would have equalized the pressure, opened the hatch, verified that the sealing surfaces were intact and clean and then reclosed for another leak check. All things that require time. But since everything had gone smoothly in our pre-departure ops, there we were, fully strapped in our seats, waiting.

It's nice not to be rushed, but of course the "sitting" position in the Soyuz is not the most comfortable one, even for a small person like me – I can imagine how painful it can be for bigger crewmembers to sit for so long with the knees bent towards the chest!

We talked, we joked, we took some glances out the windows, we reviewed procedures for the upcoming reentry, we thought about our friends on the Space Station, still so close, but already belonging to another world.

Then, at 13:17:30 Moscow time I sent the command to turn on the Soyuz docking system. One minute later, at 13:18:30 I sent the next command: Hooks Open. The electrical motors of the docking system started to drive the hooks that kept us attached to the Space Station to the open position. Within a couple of minutes the hooks were fully open and the spring-loaded pushers imparted to our Soyuz a separation velocity: on the periscope view in front of Anton's central seat we could observe the docking port further and further away. That was it, we were leaving. Good bye Space Station! Good bye Scott, Misha, Gennady! [cont]

Photo: our Soyuz departing from ISS

Logbook writtten on 2015.09.10.

Italian translation of this logbook entry: L+200/5: Ganci aperti, lasciamo davvero la Stazione Spaziale!, by Paolo Amoroso—AstronautiNEWS.