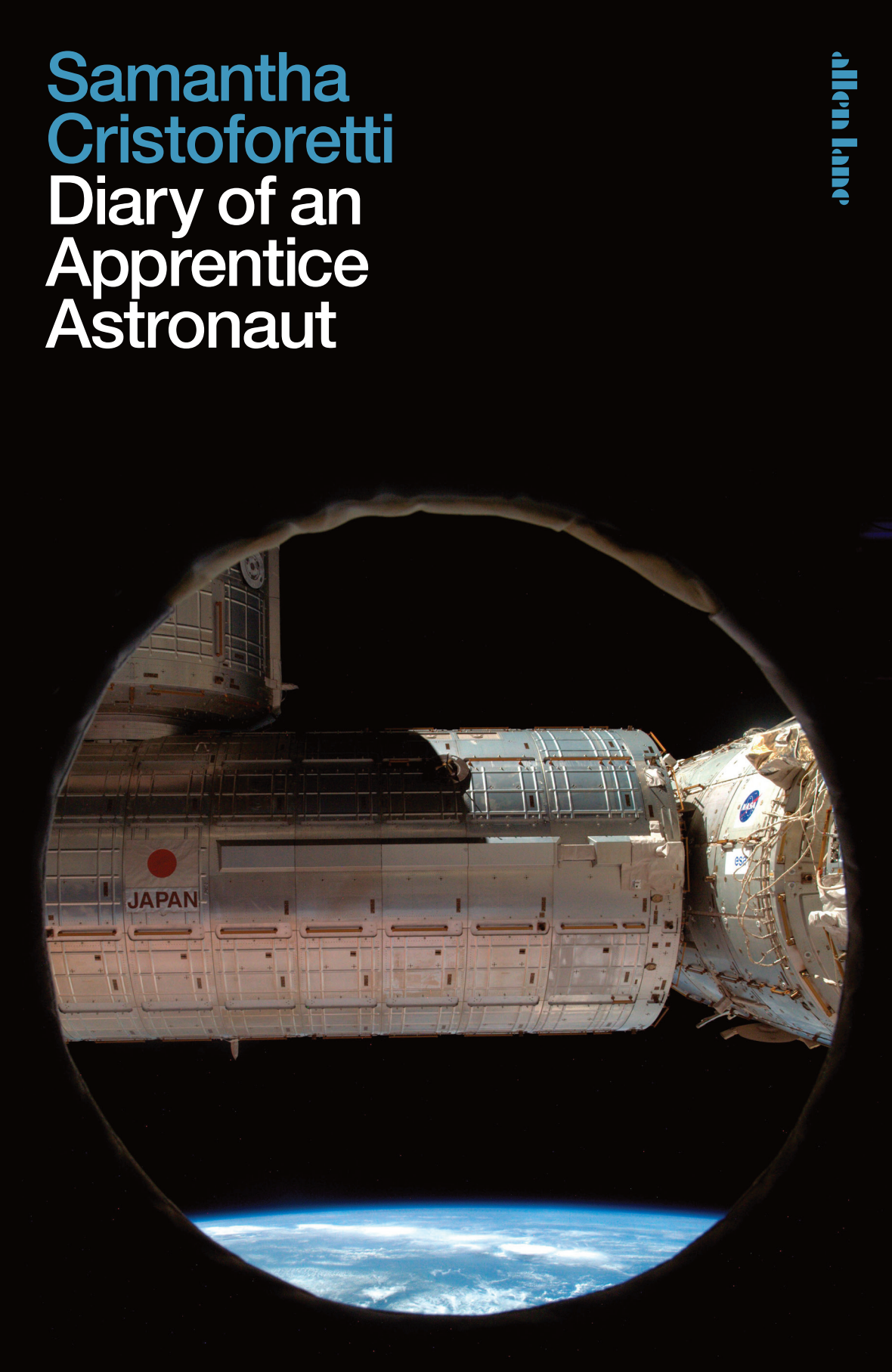
Samantha Cristoforetti

Diary of an Apprentice Astronaut



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Diary of an Apprentice Astronaut

SAMANTHA CRISTOFORETTI

translated from the Italian by Jill Foulston



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To Kelsi Amel, who came as a stargazer

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Dear reader,

This is the story of a journey. It was my journey, but I do not own this story. I'm entrusting it to you. Take care of it, though don't worry if it blends with your imagination, if it's nourished by your feelings, if it comes out transformed. That's how it should be.

Everything you're about to read is true, insofar as I have managed to avoid making mistakes. I'm afraid there may be a few, so I apologize to you here and now. I can assure you that I relied on my memory as little as possible, and only when I felt I really could.

Everything you're about to read here actually happened – but you won't find everything that happened in these pages. Out of discretion, because I only talk about the good I've found in others, and because I don't see how my private life can be of any interest. All the same, I haven't left anything out in an attempt to please you. I'm not trying to entertain you or teach you anything. I'm telling you this story – the whole of it – in the same way I would be telling it to a friend who was going with me on a long train journey. You're free to decide what to make of it.

I'll take you along during all my preparations, in the classrooms and simulators, in the swimming pool and the centrifuge, during emergency and survival drills – everywhere I go, suitcases in hand, all over the world. This is not a textbook, but we'll be picking up the many elements of an astronaut's trade along the way, a bit like collecting pebbles casually on a walk in the woods. When we arrive at the launchpad, I promise you, we'll be ready to fly into space.

This is a journey we'll make together. You and I, apprentice astronauts.

Samantha

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To know is not to pull apart nor to explain. It is to attain vision.
But in order to see, we must first participate, and
it is a hard apprenticeship.

Antoine de Saint-Exupéry, *Flight to Arras*

Lightness for me is related to precision and definition, not to
the hazy and haphazard. Paul Vale'ry said, "One must
be light like the bird, not like the feather."

Italo Calvino, *Six Memos for the Next Millennium*

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1.

Soyuz TMA-15M, 11 June 2015

We are a ball of fire in dizzying descent towards the planet, an incandescent wound in the thin atmosphere that envelops the Earth. We're slicing through the air at stupendous speed, air that gets so hot it becomes plasma. We are a falling star: if it were night, someone, somewhere would be wishing on us.

The little window on my left begins to darken on the outside, while shades of fiery orange dance around us. We're shrouded in ionized molecules of air, and they are blocking radio communication: just before we rejoin the Earthlings, our virtual umbilical cord, which has kept us connected to Mission Control in Moscow, is severed. It's almost a new birth: in a few minutes we'll emerge from the plasma, the parachute will open, and we'll make contact with the search and rescue helicopters of the Russian military already airborne over the Kazakh steppe. If everything goes to plan, we'll be reborn as Earthlings.

For 200 days, we've been extraterrestrial humans, orbiting at an altitude of 400 kilometres aboard the International Space Station. We've flown over every part of the Earth except the extreme north and south of the planet, every sea, every mountain and desert, every city and every port. We've witnessed a perpetually renewing, silent spectacle, all of it played out for billions of years before we humans laid eyes on it. As residents and guardians of humanity's outpost in space, we've inhabited weightless bodies and held weightless objects. We've felt the liberating and invigorating power of dreams come true, along with the responsibility

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of deserving, every day, a privilege reserved for few: representing humanity in space, the final frontier.

Only three hours ago we released the hooks that anchored us to the Space Station. Only half an hour ago we switched on the engine of our small Soyuz spaceship, slowing its unrelenting race around the planet. Just a bit, but enough to deliver us to the embrace of the atmosphere, which is now, little by little, relieving us of our extraordinary speed. The effect of this deceleration presses us into our seats: we're about to reach a first peak of 3.6 Gs, or 3.6 times our normal weight. Nothing out of the ordinary when we experienced it in the centrifuge on Earth, but fierce pressure after 200 days of absolute lightness.

My attention is split between my breathing, which is becoming increasingly difficult, and the display in front of me, which shows the parameters of our re-entry into the atmosphere. Everything is working perfectly: the on-board computer is automatically configuring a trajectory towards a location in the sky 10 kilometres over Kazakhstan, where the parachute will open. The voice of our commander comes through my earphones, calm and clear despite the pressure on his throat. He is making a report on the descent for the record: we're close to the nominal trajectory, and our deceleration has reached a second peak of 4.1 Gs and is now falling. No one can hear us right now, cocooned as we are in plasma, but already, many eyes are trained on the moment of our arrival.

The Astrey crew is coming home. We are the ones falling from the sky.

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2.

> 'I wonder,' he said, 'whether the stars are set alight in heaven so that one day each one of us may find his own again.'
>
> Antoine de Saint-Exupéry, *The Little Prince*

Istrana Air Base, Treviso, 18 May 2009

It was the most important phone call of my life – and I missed it because I took a few extra minutes in the shower. It's already evening, and I've lost hope of being contacted by ESA, the European Space Agency, today. But it couldn't have been anyone else: an unknown French number, no message on the answerphone. In my Spartan little room I sit down on the squeaky bed, with its blue Air Force bedspread, and I take a few deep breaths to stop the pounding of my heart, which seems about to burst from my chest. What should I do? Wait for them to call back? Call back myself? I've waited for this call for weeks, getting more and more wound up by the day. In Italy, France, Germany, the United Kingdom, Denmark, and Finland, nine other young Europeans are waiting, just like me, all of them gripped by the same anxiety. We are the final ten applicants for the position of astronaut in a selection process that has lasted more than a year. We expected it to end a few months ago, after twenty-two of us attended an interview with a group of ESA's senior managers. But we had a final surprise last month. Instead of the expected yes-or-no outcome, an end to our agonizing uncertainty, there was another call from France, with an invitation to one more test: a final interview with the director general. Only ten of us were involved. Thousands of applicants have already been eliminated in previous selection phases, but a rejection at this stage would be devastating,

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just when the dream has taken on substance and is no longer a wisp of will and imagination.

In the past few days the tension has become almost unbearable. The press conference and introduction of the selected applicants is scheduled to take place in Paris the day after tomorrow. Who would have imagined that we'd still be waiting for the final outcome at nine in the evening, two days before? Fortunately, we belong to a connected generation: either directly or indirectly, we are all in touch and we reassure each other that no one else has had any news.

I'm still sitting on my bed, not sure what to do, when an email drops into my inbox. I jump. Subject: ESA Astronaut Selection. I open it immediately, expecting only a number and a time to call back. Instead, one simple sentence, dry and technical, dissolves my tension. Every fibre in my body, my entire being relaxes. I don't cheer, I don't laugh, I don't cry. I'm pervaded by a feeling of quiet joy, and I relish a profound relief, in silence. There's no past, no future, only the dazzling present. The entire universe has stopped to give me a benevolent smile.

I reply to the email and then confirm by phone: I will, of course, be more than happy to come to Paris the day after tomorrow. And I understand I should say nothing so as not to compromise the press conference. I expected such a request, and made my excuses to friends a few days ago, letting them know that they would probably learn the outcome of the selection via the media. I call only my parents, who've watched me dream of becoming an astronaut ever since childhood, created opportunities for me, helped to make that dream a reality. I hear my own relief in their voices.

After that, I write to the remaining applicants with whom I'm in contact. If I'm meant to stick to the letter of the instructions about confidentiality, I probably shouldn't. But we promised to keep each other in the loop, and the shared torture of waiting over the past months has cemented our bond to the point where it seems unthinkable not to keep my promise. Late that night, two of them write to tell me that they haven't yet received any

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communication. No one says so, but it's clear that they probably have not been chosen. Sometimes only a thin and arbitrary line separates heady success from crushing disappointment.

Before going to bed, I look up at the patch of sky I can see through my window. One day, when I'm on board the International Space Station, I, too, will be just a bright dot up there. I can hardly believe that I've actually got to this place in my life. With a mixture of talent, hard work and extraordinary good luck, I've been able to realize something that's almost impossible. Life gave me a powerful yet insidious dream, because becoming an astronaut is terribly unlikely. Now, however, the path towards space is open. I may have to wait many years but, sooner or later, I trust that a rocket will be waiting for me on the launchpad.

I go to sleep thinking: today I found my star.

—

It had all begun more than a year earlier, in the changing room at a swimming pool close to the Istrana air base, northwest of Venice, where I was stationed. After my evening swim, I was surprised by an unexpected flood of emails, texts and calls, all with the same exciting news: according to various sources, the European Space Agency was about to start the selection process for a new group of astronauts. Although no one said it outright, there was one clear message flowing through the words of my friends and family: This is it! Here was my chance to realize my life's dream.

I reacted cautiously, tamping down my excitement to avoid the disappointment of a false alarm. What were the requirements? Was I sufficiently qualified? I worried that the moment had come too soon. At thirty-one years old, I was younger than most European or American astronauts when they were selected, and I had barely begun my career as a military pilot. I was a long way from qualifying as a test pilot, something I hoped to do one day, since it's always been a privileged gateway to space. I still needed a few years.

On the other hand, by the time the next chance rolled around I'd probably be above the acceptable age. The selections in the United

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States and Russia take place every few years, but in Europe they are very infrequent, a once-in-a-lifetime opportunity for anyone aspiring to be an astronaut. The last one had been ten years before, in 1998, when I was still attending the Technical University of Munich. It was the year they launched the FGB, the first module of the International Space Station, and I was finishing up my second-year exams in mechanical engineering and looking forward to a specialization in aerospace for the next three years. I was twenty-one years old, a sadly significant age, since it was the cut-off for entering the Italian Air Force Academy as an aspiring pilot. I'd long contemplated this career and eagerly waited for the Italian armed forces to open up to women, so far in vain. There have been many favourable circumstances in my life, but perhaps the most outrageously lucky was this: the very next year, in a turn of events both surprising and unexpected, the law introduced voluntary military service for women, temporarily raising the age limit for female applicants and opening up an opportunity that seemed to have disappeared. So, despite the practical difficulties of travelling to Italy to take part in the admission tests and screenings, it was an obvious choice for me to apply in my last year of university. I was in Moscow then, grappling with my thesis on solid rocket propellants. At first I was doubtful about my chances for success, but one day in August I received a telegram summoning me to the Air Force Academy. I couldn't believe it: I'd come first in the admissions competition.

That's how I ended up in the changing room at the swimming pool all these years later, thinking back to the somewhat risky decision that saw me starting a new bachelor's degree course all over again. Me, a twenty-four-year-old, in the same class with students just out of high school and much younger than me. Spurred on as I was by the announcement of the imminent selection of astronauts, I questioned the wisdom of that choice, which had cost me dear in terms of freedom, relationships and alternative futures. Of course, it would bear fruit, but only slowly. After the Air Force Academy, I had earned my fighter pilot wings in the US and then I had taken the generic lead-in fighter training in Italy. Only now, after long months of waiting, a spot had opened up for me at the Operational Conversion

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Unit in Amendola, near Foggia. There, I'd begin the course specific to the aeroplane assigned to me, the AM-X fighter bomber.

I was happy, sure, but I'd far rather have faced the astronaut selection with my course under my belt! So many unknowns sprang to mind as I returned from the swimming pool to my little room at the air base. Maybe ESA would immediately reject me as an applicant, judging that I didn't have enough flying hours. Or the Air Force wouldn't authorize me to take part in the selection process since I was still in training. And what an ironic twist of fate in the unlikely coincidence that, just as I was about to embark on a very difficult course that would demand my utmost dedication and focus, ESA should announce a new astronaut selection: I would need to give this chance of realizing my life's dream everything I had. How would I balance the two objectives together for an entire year? How would I give my all to one of these goals without compromising the other?

A few weeks later, I transferred to the Amendola air base, full of misgivings, to settle into yet another furnished room. From Bolzano to Minnesota, Munich to Toulouse, Moscow to Naples, Texas to Treviso, I had been travelling light since my teens, with just a few bags, which allowed me to erase all traces of my presence with ease, and temporarily put down roots in another place. I've never suffered from nostalgia, though I would many years later, when I returned to Earth from space.

Still, I stubbornly kept in touch with many friends I had met in those years of nomadic life. When I shared with them the news and the hopes of the moment, I received in return many heartfelt messages of encouragement, which made it sound like becoming an astronaut was now just a mere formality. I could only smile at their words and take it all with a pinch of salt, knowing full well that in friendship objectivity can be obscured by affection.

On the other hand, I took great comfort in a conversation I had with Maurizio Cheli, a former test pilot with the Italian Air Force and veteran of a Space Shuttle mission. We were put in contact through a shared acquaintance, and during a long conversation, which I'll always remember with gratitude, he listened to me

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carefully and offered precious advice and encouragement. He even declared at one point, 'You're the perfect candidate!' But he quickly added a sobering remark: 'Only a handful of people will be selected. This will be a dogfight!!' Indeed so . . . Who knew how many 'perfect candidates' from the then seventeen member states of ESA were queueing up to participate in the selection?

I'd been in Amendola for a week, buckling down to my theoretical course on the AM-X systems along with three wonderful classmates, when on 19 May the website astrosel.esa.int went live. To get a password allowing you to access the site, you had to send a medical certificate confirming your fitness to fly as a private pilot: a clever way of eliminating applicants who were clearly unfit.

Once you had the password, you could access a long questionnaire asking detailed information about your school and university education, as well as your professional background. There was also space to include flying hours or scientific publications, language skills, level of manual dexterity, experience in public speaking, volunteering, hobbies or sports – with a particular emphasis on activities such as diving, caving or parachuting. Finally, I had to provide a brief explanation of my motivation and my idea of an astronaut's duties. I had to describe my strengths and weaknesses and include any additional information that supported my application.

I spent many hours completing the questionnaire, reading and rereading it, correcting and explaining, adding and cutting. I imagined scores for every field and speculated on possible key words for the open-ended questions. I tried to be succinct yet thorough, sifting through my personal history so as not to forget anything – a course, an experience, some skill that might make a difference. From Monday to Friday, I spent long days in the classroom, listening to lectures on AM-X systems, followed by equally long evenings spent studying aircraft manuals and preparing for frequent tests. On weekends, I concentrated on the ESA questionnaire with maniacal attention to detail, an instinct picked up both in my engineering studies and in my military pilot's training. I was acutely aware that a detail on the questionnaire could spell the difference between entering the 'dogfight' – or instantly relinquishing my long-cherished dream.

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My potential futures were now inextricably interwoven and would continue to be so throughout the coming year. Four weeks had gone by, and it was time to send in the questionnaire. Simultaneously, the initial series of lessons on AM-X systems was ending, making way for in-flight training. For the first time, and after much anticipation, I found myself at the controls of a proper combat aircraft, not just a training plane. The cockpit of an AM-X was where I most wanted to be while I waited to hear if I'd be going into space some day.

A couple of weeks later I was preparing for my first solo flight when the email I would anxiously await at every step of the selection process popped into my inbox for the first time:

From: astronautselection@esa.int
Subject: Congratulations!
Signed: Michel Tognini, Head of the European Astronaut Centre

I was overcome with joy and, more than that, a liberating sense of having escaped danger. It was only the first step, and I was one of a thousand remaining applicants, yet this meant that 7,500 people had already been eliminated. That stage was over, the one that had seemed to me most random, most unpredictable, most subject to chance. Now I was really in the 'dogfight'. My CV had aroused sufficient interest, and from now on I was convinced it would no longer be about formal requirements but about demonstrating the right combination of skills and personality. Even considering all my limitations and the ever-present possibility of making mistakes or meeting unfortunate circumstances outside my control, I now felt like I was in with a good chance.

Barely ten days later, I joined one of the first groups of forty applicants convened in Hamburg for an entire day of aptitude tests, a series of exams administered by computer, with brief intervals. The day was exhausting. The pace was fast, and the tests demanded a heightened level of attention and concentration for many hours. I found the tests in English, maths and mechanical comprehension something of a relief, since they had to do with acquired knowledge

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and therefore required less mental effort. The other tests, however, examined purely cognitive faculties such as sustained concentration, 3D visualization, visuomotor coordination, attention allocation and visual and auditory memory. We finished those tests with a sense of inadequacy, because you couldn't beat the computer: in each case, the speed and level of difficulty progressively increased until, inevitably, the human brain reached its limit, and the errors multiplied. Thanks to a good short-term memory and a certain familiarity with associative techniques for memorization, I was almost sure I hadn't made any mistakes on the test for visual memory. But with regard to the other tests, I shared the general sense of uncertainty. It was impossible to know how we'd done, and we could only speculate on the evaluation criteria. Only much later, while I was already in training with ESA, was I able to confirm one of the most widely held theories in the evening discussions back at the hotel: rather than achieving performance peaks on some tests, it was important not to drop below a certain threshold in any one of them. Today I know very well that an astronaut is not required to excel in any one particular thing yet should be able to manage fairly well in everything.

I left Hamburg feeling cautiously optimistic about my test results, and with mixed excitement and apprehension about other applicants I'd met. Many were engineers and scientists already professionally active in the space industry; some were actually already with ESA. It had been great to meet so many brilliant men and women, all of them passionate about space, to engage with them in enjoyable and stimulating conversations and discover a natural bond with hearts that beat with the same dream.

However, I also noticed how, having had my head down over the past few years, studying to be a pilot and taking my first steps towards a career as a military aviator, my connection with developments in space exploration had become increasingly tenuous. I was never obsessive about my dream to become an astronaut. I never collected autographs or souvenirs, didn't follow every little bit of news on the Space Station and I never tried to get in the loop about forthcoming astronaut selections. I'd always felt it was important to

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concentrate on the task of the day, and in recent years my daily routine had been grounded in my pilot training. But now, as I hoped to move forward in the selection process, I felt the need to immerse myself in the world of space. I had some revising to do and lots of gaps in my knowledge to fill.

On weekends I started going to a friendly café in Foggia with an internet connection where I caught up with several years of space news. If I went to the beach, I took along my books on space propulsion or orbital mechanics. In the car I listened to the audiobook of the first *Harry Potter* in Russian, a gift from a dear friend in St Petersburg. I chose a children's book in the hope that it would be easier and more suited to my rusty language skills. The most obvious result is that today I still have a small, but enviable vocabulary of Russian magical terms.

With hindsight and a long space mission under my belt, I am convinced that my experience in the Air Force taught me things no doctorate in engineering could have: discipline, humility, resilience, a sense of my own limitations, attention to detail, teamwork, leadership and also followership. I was confident that this sort of competence would make the difference in the end, when the highest-scoring applicants in the cognitive and psychological tests remained. But I also wanted to make sure that if I found myself among them, a question on Kepler's laws or an invitation to converse in Russian wouldn't catch me out.

At the same time, my AM-X course was very demanding, and the pressure of running two parallel marathons would lead to difficult moments in the months to come. Preparations for a flight of just over an hour required many hours of planning, and the in-flight training was accompanied by a packed programme of classroom lessons and tests, before we could move on to new and more complex types of missions. We had regular simulator sessions and thick training manuals to study the plane's most advanced systems, weapons and their use, communications procedures and rules of engagement. It was towards the end of that torrid summer in Apulia, when the only day off had been the public holiday of Ferragosto in mid-August, that the ESA email I'd yearned for finally arrived with

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the good news: I had been admitted to the next phase of the selection! There were now 192 applicants remaining.

We were invited in groups of six to the European Astronaut Centre in Cologne for a second day of psycho-cognitive evaluations. This time around, they focused not on individual performance but on relational skills, communication and problem-solving in groups.

I did the first test with Martin, a friendly German with a PhD in maths. The test involved a sort of video game, and our duty was to optimize car traffic. Each of us, individually, was responsible for half the city ('City West' or 'City East'), but the data necessary for making decisions were visible only to the other person, so we needed to exchange information rapidly and efficiently as well as give timely instructions to one another. In the few minutes we had to prepare, Martin and I agreed on what seemed like an effective protocol for communication, loosely inspired by the concise and effective radio jargon of military aviation. The initial warm-up run went quite well, it seemed, and we were pleased with our strategy, but to our surprise the observing psychologist was not impressed: she advised us to adopt a less severe tone for the actual test and to indulge in some polite formalities. Perhaps taking our cue from the dry and essential exchanges typical of military flight wasn't the ideal strategy for making a good impression. In the years to come, however, despite the short way in which we seem to have talked to each other, Martin and I would exchange emails regularly, jokingly calling each other 'City East' and 'City West'.

The group as a whole was later assigned a timed task to solve together. The problem was fairly complex, and we were being observed by a committee of psychologists, human resources professionals, doctors and a veteran astronaut. It's possible that there was no solution to the problem, but I couldn't help feeling some disappointment when, after a rather rambling discussion, our time was up and we had no suggestion to put forward. Whether for fear of exhibiting a tendency to dominate or reluctant to meet resistance from the rest of the group and end up in an embarrassing situation, no one had assumed the role of coordinator. I quickly weighed up the risks and forced myself to ignore them. My instinct was that

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this was not a moment for tactical manoeuvring. The only correct choice was to act in line with my character. As far back as I can remember, I've never been shy about assuming a leading role when necessary, and I wasn't going to start that day. When they presented us with the second problem, I leapt at the chance to put myself forward as moderator, and I made no bones about guiding the discussion, aiming to work in a structured manner so we could find a solution this time. Weren't we among the 200 applicants judged to be the best in an in-depth cognitive evaluation? When our time ran out, we had a valid proposal to present – and at the end of the test, the thanks I received from some of the applicants for taking the initiative convinced me that I'd done the right thing. I was pleased with myself, but that's rarely a good sign, and I'd have sorry confirmation of this during the interview each of us would have later with the observing committee.

It was late afternoon when my turn came, and I felt tired but confident. The applicants who'd already been interviewed had reported that the atmosphere was friendly and relaxed, and it seemed like the day as a whole was going well. So I took my place in front of the commission with a genuine smile. But when I stood to leave after forty minutes that seemed to go on for hours, my forced smile required all the discipline I had. I was sure that the selection had ended for me right there. A couple of members of the group didn't like me at all; I was convinced of it. The atmosphere was tense, and they asked me to account for my behaviour during the group exercise. It was clear that in their view I had been overbearing with the other applicants. Maybe, by nominating myself as discussion moderator, and in my zeal to obtain a result, I'd crowded out my colleagues. Maybe I'd failed to show consideration for all the ideas put forward. Or maybe I'd based my interaction once more on ways of communicating that were best suited to the military. Maybe, maybe, maybe . . .

In the weeks to come I would relive that interview hundreds of times, to the point where I hated myself for not being able to set it aside. It hadn't been only tension and awkward answers. A lot of it was relaxed and had gone well. I felt I'd made a good impression on

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several members of the committee, and it was even possible that the hostility I'd sensed from some of them hadn't been real, just a way of putting me to the test. But in any case, I was consumed by the agonizing fear that I'd let my dream evaporate in a matter of minutes, one afternoon at the beginning of October in Cologne.

The following two months of waiting were exhausting, probably the darkest period of my life. For weeks I lived with frequent headaches, and sometimes they only went away in the cockpit. With the exception of the Pill, I didn't have any other medication around at the time. Headaches were a rarity for me, and whenever I did have one, I calmly put up with it without taking painkillers. Even then, when they were plaguing me almost daily, it didn't occur to me to take anything for relief. My impractical approach to life had often been the subject of good-natured ribbing on the part of friends and colleagues.

In November, the course transferred to the Decimomannu air base in Sardinia for training at the nearby Capo Frasca firing range. This was a particularly demanding phase of the training, our commander advised us, and it was common to meet with difficulties. Sure as anything, I did, to the extent that they threatened the outcome of the course.

One Sunday I had news of an impending death in my family. I was plunged into a deep despondency. I cried at length and didn't even touch the materials needed to prepare for the sortie the next day, suddenly overcome by a paralysing sense of fatalism. That night, the AM-X course and the astronaut selection seemed only trivial details, and my interest in them a whim.

I've met many pilots with such natural talent that they can allow themselves to fly with little in the way of preparation or sleep, knowing they'll perform well anyway. I wasn't one of them. The right thing to do the following morning was to pull out of the flight. But I didn't. Due to a prolonged period of bad weather, we were already very late with the sorties planned for the course, and I'd lost extra days because of a nasty pulled muscle in my neck, so the thought of causing further delay felt unacceptable. I went up in the air as number 4 in the formation and,

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when circuiting the firing range in conditions of limited visibility, I created a potentially dangerous situation that cost the mission a negative evaluation.

Although it was a serious error, it was a fairly common one during training at the firing range, so the instructors weren't all that concerned. With the best of intentions, and to help me recover the situation as soon as possible, they added me to another formation going up soon after. Of course, no one could have known about the emotional state I'd been in the night before. Once again, I failed to bow out of the sortie, taking another irresponsible decision. Once again, I made a serious mistake. Once again, I got a negative evaluation. Two failed missions in one day. It's hard to imagine a worse situation: three negative evaluations in a row and I would have been expelled from the course.

With years of hindsight I can say that that miserable day proved to be a blessing in disguise. In a brutal way, it sent me a powerful warning I needed to hear: I could not allow myself to be distracted or to take decisions lightly. As is often the case, the threat of immediate danger unleashed all the power of concentration, and fortunately I continued to believe that I could get through if I gritted my teeth. There were also some lucky circumstances. As expected in these situations, I was placed under the care of a small group of particularly able instructors. And throughout those weeks of struggle, I could rely on the friendship of my three classmates, who were always there for me, extending a favour or just lightening the mood with a joke.

Wrapped up as I was in the course at the firing range, I gave no further thought to the interview in Cologne. My headaches went away and, as is so often the case when I'm utterly focused on a single objective, I began to feel well even though I knew there was still a steep climb ahead. I completed this phase of training at the firing range with no further hitches and I went back to the Amendola air base with a renewed, if cautious, sense of inner peace.

Late one afternoon, I was finalizing a map, using red circles to indicate the range of non-existent ground-to-air missiles scattered across a virtually hostile area my formation would fly over the next

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day, when I got an email that ended two months of enervating uncertainty.

> Dear Astronaut Applicant, it is my great pleasure to congratulate you . . .

Exultant, I left the room, bursting with joy and unable to contain myself. I'd waited for too long and thought too often that the outcome would be very different.

That evening, after pouring out my joy in emails to my family and friends, I joined ongoing conversations between applicants within the different groups that had sprung up after we'd met in Cologne and Hamburg. Many had received bad news and were leaving the selection process. We, the lucky ones, were going ahead, still incredulous, and we were at a loss for words with the unsuccessful applicants. We couldn't explain what had made us stand out and we felt their disappointment keenly.

We found out that there were forty-five of us left, and we were soon sifted into groups of seven or eight for a whole week of medical visits. I got a call one day from Brigitte, a French doctor I remembered meeting in Cologne. In order to schedule me on one of the weeks of visits, she needed to know the date of my last period. My potential employer's interest in my menstrual cycle definitely underlined – as if it were necessary – the fact that being an astronaut isn't any old job! As it happened, over the coming years, Brigitte's characteristic French accent would become very familiar as we continued our early habit of sharing personal issues. In fact, she was to become my flight surgeon. Not only did we discuss at length how menstruation can be suppressed in orbit, but she was the first person at ESA to learn, a few months after the mission, that I was expecting a baby.

Along with the summons, ESA sent a document briefly describing several dozen tests we would have to undergo. These were purely medical exams which ranged from a routine dermatological check-up to a bone-density check. There were no centrifuges, rotating chairs, isolation chambers or any of the other particularly

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arduous or spectacular exams the collective imagination associates with astronaut selection. There was therefore nothing for us to do in preparation, since you cannot hope to change your state of health in a few weeks. So I just carved out a bit more time for sports, tried to eat healthily and lost a few kilos in order to reach what I considered my ideal weight.

On the evening before the visits began, I had supper with some old university friends and then joined my fellow adventurers in a little hotel a few hundred metres from the entrance to the campus of the German Aerospace Centre. It was their Institute of Aerospace Medicine that would be conducting the medical evaluations. As I took my seat, I realized to my surprise that I knew the woman sitting next to me: Regina had begun the mechanical engineering course in Munich a year after me, and we'd lost touch with one another when we'd both gone abroad to study. Here we were ten years later, I, a military pilot, and she, a PhD in aerospace engineering with a demanding job in a consultancy firm. These days she is one of the happiest people I know, but Regina was then deemed unfit because of a completely asymptomatic medical problem. Her dreams were shattered because of a small detail completely beyond her control that had no bearing on her daily life. No doubt she would have been none the wiser if not for the tests imposed by the ESA selection.

The week flew by between medical exams and spells of waiting in a basement room filled with irreverent laughter and the sort of swaggering you get from military pilots, who made up the majority of our group. Cardiologists, orthopaedic specialists, ophthalmologists, ENT doctors, gynaecologists, psychiatrists, dentists, gastroenterologists, radiologists and ultrasound technicians . . . Over five days and according to a rigid schedule, we saw every type of specialist in an organized migration from one hospital department to another, one room at the Institute of Aerospace Medicine to another.

I left at the end of the week with some misgivings regarding my eyes, since after the first in-depth exam, which went on for several hours, I'd been subjected to a second check. I've always had perfect vision, and it seemed odd that my eyes might be letting me down, but the fact was, nobody else had been recalled by the ophthalmologist,

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though almost everyone had had to repeat at least one exam. There was no point in asking for an explanation: we would only be informed right away if they found a condition requiring immediate medical attention. Otherwise we would have to wait a few weeks to learn the results, as with all the previous steps in the selection process.

This time, I didn't have to wait for long. Around the middle of February I got the email I'd been waiting for:

From: astronautselection@esa.int
Subject: Congratulations!

So my eyes had not let me down in the end! The healthy body I'd won at the lottery of birth, which had never required much attention, which for so long never grumbled about being ill-treated by a hectic lifestyle, too little sleep, poor eating habits or psychological stress . . . the body that had only in the past few years begun to send me timid messages that got me to pay more attention to my lifestyle . . . that body was still giving me its full support: you're off to space, Samantha!

One small detail remained: the selection process was not yet over. Before the end of the day, emails began to fly thick and fast among the applicants: some had already been contacted, some would hear the good news or the bad only the next day, after twenty-four hours of torment. Our pan-European intelligence network soon revealed that there were twenty-two of us still in the running. Despite our best attempts, it was difficult to calculate our chances for success. We didn't even know how many of us would be chosen. Four? Five? Six? ESA had never stipulated an exact number. Surely there would be some sort of balance between nationalities: it was unthinkable, for example, that two out of five would be British, or three out of six German. We knew that if the selection process to this point had been solely based on single-applicant evaluations, from now on the balance and composition of the final group would be the main objective. All of us who had got through to this stage were probably suitable as astronauts. Now ESA would have to put together a team.

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Of course, there's always a way to ruin a good impression: showing up poorly prepared for an interview with ESA's senior managers, for example. That would be the final stage of selection, or so we thought; we still didn't know about the additional interview with the director general. It wasn't the time to let down your guard; quite the contrary. Summoning up all my courage – or maybe my *chutzpah* – I knocked on the door of the squadron commander, the officer ultimately responsible for completing our training. He was a reasonable man and, as it turned out, really passionate about space. What's more, he had always shown himself to be agreeable towards me, something I didn't take for granted. I was, after all, hoping to be selected as an astronaut, and that would have made my AM-X training irrelevant for my future employment. I was also asking a great deal. I wanted a week off from training to focus entirely on preparing for the coming interview. It was really bad timing for such a request, since our course had already been extended beyond its usual length. But I had to ask. Twenty-two applicants remaining. It seemed all I had to do was reach out my hand to touch my dream.

Thankfully, and to my immense surprise and relief, the squadron commander agreed without a moment's hesitation. Years later – he was then a friend – he came to Baikonur to attend my launch and a few weeks later he wrote, 'You seem to have been born to do what you're doing.' Who knows? Maybe he was thinking that in his office in Amendola, when we had that unusual conversation.

For one week, I forgot all about the AM-X in order to immerse myself totally in the world of spaceflight. I even spent one Saturday shopping, an activity I find about as appealing as a trip to the dentist. I explained to three sympathetic assistants in a shop in the centre of Foggia that I was looking for an outfit for an important interview, and they spent a lot of time and took great care in helping me choose a simple, yet elegant suit. And then I set off for rainy Noordwijk, a Dutch city on the cold North Sea and the site of ESTEC, ESA's European Space Research and Technology Centre.

The interview turned out to be focused on personality rather than technical skills. In a relaxed, occasionally even cheerful atmosphere, committee members took it in turn to ask questions, many

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of them about how I would behave in situations of interpersonal conflict, where there was disagreement over values and priorities or disappointed expectations. Apart from the line-up of senior managers – they'd hardly attend an ordinary recruitment of young applicants, I thought – none of it seemed very different from a normal job interview.

I left the interview calm and confident. I felt we had connected and it didn't seem that any problems had come up. As far as I knew then, the selection process was finished. I'd done everything in my power, given it my all, and it was no longer in my hands. I couldn't do anything now but wait. I had no idea as yet how the long wait ahead would wear me down, nor could I anticipate how exhausting those last nerve-racking days would be, when an announcement was imminent, and I jumped nervously every time the phone rang, at every flash indicating a missed call. My emotional investment was now so great that a negative outcome would have left me staggered.

So on that May evening in my little room at the Istrana air base, I welcomed the news of my selection with an immediate release of tension and a profound sense of relief. Only in the coming days did trickles of joy, satisfaction, even a little pride about joining the European astronaut corps, slowly soak every fibre of my being.

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3.

> I was sitting in a chair in the patent office at Bern when all of a sudden a thought occurred to me: 'If a person falls freely he will not feel his own weight.'
>
> Albert Einstein, Kyoto Conference, 1922

Kennedy Space Center, Florida, 8 February 2010

'T-9 minutes and counting,' a voice comes over the loudspeaker. It's only just past four in the morning, and the illuminated panel in front of the stands indicates that the countdown has started again after a planned hold. In front of us stretches a mirrored expanse of water, barely ruffled by a light breeze, but all eyes are trained beyond it, about 6 kilometres away, where powerful spotlights are washing over Launch Complex 39A. There, rising from the launchpad in all its glory, is the Space Shuttle Endeavour, and in its capacious cargo bay are two new modules for the International Space Station: Node 3 and the Cupola. They arrived last June from Turin and will go to complete that fabulous human outpost in space, continuously inhabited by astronauts for almost ten years. The Cupola, with its big windows, will offer them a breathtaking view of the Earth.

I look up somewhat worriedly at the sky, where starless patches betray the presence of clouds. I'm quivering with the desire to see my first space launch, but it may not take place tonight. The first attempt, yesterday, was postponed because of the clouds, and the odds of launching today are estimated to be 60 per cent. The Space Shuttle is an incredible machine, but also an extremely complex and demanding one. It's not only the weather conditions here at Kennedy Space Center that must be favourable, but

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also those in at least one of the three emergency landing sites on the other side of the Atlantic. Knowing full well that a launch can be repeatedly delayed, I've given myself a good two-week margin. I have no intention of missing this launch, since I won't have another chance to come to Florida during my basic astronaut training, and the Space Shuttle will complete its last mission in a few months.

My being here today is actually a very lucky circumstance. Right now, my colleagues are in St Petersburg for an intensive Russian course, which wasn't considered necessary for me. After the first month of lessons in Germany, I asked to take the exam to certify my proficiency level, which was deemed more than sufficient to fly in a Russian space vehicle. As much as I cherish the dream of improving to the point where I can enjoy Dostoevsky in the original one day, a holiday in Florida for the launch of Endeavour was more enticing than a course in St Petersburg in February.

The Space Shuttle has been a constant presence in my world. I was four years old when Columbia made its maiden flight, and I well remember the pictures of the Challenger accident on television when I was nine. I was a teenager when, for the first time, a fellow Italian went into space, making it seem all the more possible that, one lucky day, it might be me. And it didn't escape my attention when, a few years later, Colonel Eileen Collins became the first woman to serve as pilot, and then commander of the Space Shuttle. Unfortunately, my generation of astronauts won't be able to fly in this exceptional vehicle before it's retired from service. Until new American space capsules are developed, the only way of reaching the Space Station will be to fly in the Russian rocket Soyuz, and in the small spaceship of the same name.

The countdown resumes after a planned hold. Seven minutes from lift-off, the access bridge that allows the team to take their seats on Endeavour is retracted. The large external tank, bright orange, contains 800 tonnes of cryogenic propellants, liquid hydrogen and oxygen at very low temperatures. A small amount inevitably evaporates and is discharged through dedicated relief

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valves, creating the characteristic puffs of white vapour that shines in the lights on the launchpad. When the main engines are switched on, powerful turbopumps will funnel hydrogen and oxygen into the combustion chamber. But it's the solid propellant boosters – those two huge, white, cigars on the sides of the external tank – that provide the first and most powerful push against Earth gravity.

I wonder what the six crew members are thinking right now, seated uncomfortably for hours in their orange spacesuits, their backs parallel with the ground. It's the first mission for one of them, pilot Terry Virts. I can imagine he's consumed with the desire to lift off.

At T-4 seconds, I watch as the main engines are lit. Lift-off isn't yet inevitable: if one of the engines should fail to work properly, there would still be a way to halt the launch sequence. But not once the solid-propellant boosters are ignited as the countdown comes to an end and Endeavour, heedless of its 2,000-tonne weight, lifts off over Cape Canaveral in a sudden explosion of light so bright it turns night to day. Despite the distance, the noise is intense, and my whole body begins to vibrate with the sound waves. Enveloped by white vapour from the cooling water, the launchpad continues to radiate an intense glow, while the Shuttle climbs rapidly through the sky towards the northeast. It ascends through thin layers of cloud which, with the approach of Endeavour and its dazzling tail, emerge from the darkness in a play of light and shade worthy of Caravaggio – and are then swallowed up again by the blackness of night.

The boosters shut down after two minutes, as planned, and then drop off into the ocean, where they will be retrieved for refurbishment. The main engines continue to thrust Endeavour on in its race towards orbit. For nearly seven minutes I manage to follow it, a point that grows increasingly distant and imperceptible, until it disappears completely behind high and distant clouds. I couldn't have wished for a more spectacular launch.

Fifteen years ago, when I was an exchange student in the United States for a year, I spent a week at Space Camp in Huntsville,

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Alabama, not far from where I am now. We studied the Space Shuttle for fun, as much as we could in the short time available, and then we simulated a twenty-four-hour mission. And now, thinking of the Endeavour crew about to reach orbit, the images overlap with my memories of that experience.

I can't imagine any better occasion than this spectacular launch for properly taking leave of that teenage Samantha. The time has come to move from the dream of being an astronaut – a brilliant, but vague dream – to the concrete reality of building an astronaut's future. Or maybe this transition is just an illusion: maybe the beating heart of the child who yearned for space, maybe the dreamy gaze of the girl who lost herself in sci-fi adventures are still there. Maybe these aren't only faint traces, but remain the mysterious source of my actions and feelings.

All of them – the child, the girl, the woman – are alive within me, the apprentice astronaut.

—

I couldn't know that night that, only a few years from then, my own life would be inextricably intertwined with the life of the Space Shuttle pilot then making his first space mission. Nor could I have dreamed that the man standing next to me on the bleachers, whom I had only just been getting to know, would become my life's companion.

For now, looking ahead, I could only see one certainty: the basic astronaut training, which, for the first time, was taking place in Europe. At the press conference in Paris the previous May, I had had the first opportunity to meet all together my five companions in this venture in one place. It's where I got to know Tim, Alex and Thomas and met up again with Andy and Luca, whom I'd originally got to know during the medical exams. We were more or less the same age, and we were going to spend the fifteen months of the course together. Luca and I shared not only Italian nationality; we also both belonged to the Air Force. He'd joined up when he was much younger – right after high school, and during those months he was finishing the course as a test pilot for rotary-winged aircraft. Together we took part in

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another press conference the next day, in the crowded press room of Palazzo Chigi, seat of the Italian government.

In the weeks that followed, the Air Force received an unusual number of requests for interviews and public appearances. Their decision, at least initially, was to accommodate the media interest and try to satisfy it. It embarrassed me, but surprised no one, that attention was primarily focused on me, 'the first Italian female astronaut'. While I found myself fielding questions that were often frivolous, along with expressions of admiration and astonishment that clashed with my sense of reality, Luca took things with his customary self-deprecating sense of humour. He'd often smile and introduce himself to journalists with the greeting, 'Hi, I'm the other one!'

We hadn't had any kind of press training, but one day ESA sent us some guidelines. I still remember four of them because even now I consider them the Golden Rules: never lose your cool; speak only about what you know; don't discuss politics; don't discuss your family or your private life.

They were simple rules based on common sense, but they were useful in terms of steering through that early summer maelstrom. At the time, I didn't know yet how to separate myself from my media image or the public conversation of which I was the subject. And I wasn't free to decide, to select or to request appropriate forms of collaboration as I am these days, most of the time. So I was very happy to use my saved holiday in order to retreat from the bewildering clamour of those weeks.

In view of my new ESA assignment, I needed to find accommodation, so I went to Cologne, where, for the first time in my life, I signed a rental contract for something more than just a furnished room. I chose a small apartment in Sülz, a pretty area on the left side of the Rhine only fifteen minutes by tram to the centre of the city and its famous Gothic cathedral. I moved in late one evening a few weeks later, having driven all the way from Italy. I had with me a few suitcases, a chair and a camping table, and my computer and printer. I arranged those few things in the living room, the only room with a working light bulb, and blew up an air mattress to sleep on.

Happiness always takes me by surprise, sneaking in unexpectedly,

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almost inexplicably. I think it must grow inside, slowly and quietly, until some small detail makes it spill over, and all at once it saturates body and soul. Or maybe it's always there under your skin, waiting for you to make room for it. That night, I went to bed coddled by the expanse of clear sky I could see through the big windows in my living room. The full moon came out, haloed in silver – and suddenly I was happy.

On 1 September, we showed up at the European Astronaut Centre (EAC) for the first day of school, curious and excited about our future training. I had visited EAC more than ten years earlier, when I was still studying aerospace engineering. The opportunity had been offered during the course on human spaceflight taught by the German astronaut Reinhold Ewald. I still have a photocopy of a cover article from a 1998 issue of *Scientific American* that Reinhold handed out to us at the time, and in which the American astronaut Shannon Lucid talked about her extraordinary experience: 188 days on the Russian Space Station MIR during the pioneering years of space collaboration between Russia and the United States.

I discovered that Reinhold's office was now right across from mine at EAC. Or rather, ours, since I would share my office with Andy, a Danish aerospace engineer with a PhD and some years of experience working on offshore oil rigs in West Africa.

We wouldn't be spending much time in our office over the fifteen months of basic training. From the very first day, we had a full schedule that usually kept us busy from 9 a.m. to 6 p.m. The initial four weeks were spent mostly on introductory lessons, some of them technical and many organizational: How does ESA function? What are its main programmes? How is astronaut training organized? In a classroom reserved for us, we watched thousands of PowerPoint slides. Some days our schedule included sports; on others we had to carve out time at lunch or the end of the day.

Although most lessons were not that demanding, the days were still very long. I sometimes managed to leave in time for a quick trip to IKEA on my route home before it closed. But there were days when I got home late to my apartment, where, in addition to furniture, I still lacked internet service, a washing machine and curtains.

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Despite this, I immediately felt at home in Cologne, a welcoming city that doesn't take itself too seriously, so much so that Carnival season there goes on for three months.

The excitement of a spaceflight was some time away from those early days of sitting in lessons, but I continued to feel like Alice in Wonderland. EAC was a special place, a small centre with roughly 100 specialists from all over Europe, including Russia, who were dedicated to the support, training and medical care of astronauts. To my delight, I rediscovered the beauty of a multicultural environment – starting with the pleasure of hearing conversations in many different languages. The lessons, too, were becoming more interesting. A series of short, intensive courses began on various subjects – from biology to geology, information networks to crystal growth – each with a short final exam. The aim was to provide us with a kernel of knowledge in areas related to the technological and scientific aspects of spaceflight, so that we'd be able to communicate effectively with the scientists and technicians we'd be working with once we were assigned to a mission on the ISS, or International Space Station.

We knew very well that our finish line, the ISS, was still a long way off. In the best-case scenario, the first of us would go to space four years from then, and at worst, the last of us might have to wait for up to ten. We were six able and ambitious apprentice astronauts, and I had no doubt that all of us would complete the training with excellent results. The order in which we went into space would depend on the rotation of missions among the ESA member states and not on our proficiency. In a sense, this was a relief. We weren't in competition and could dedicate ourselves unreservedly to the success of our group as a team.

We spent those first months in the little bubble of our raised classroom, which overlooked the large training hall dominated by a mock-up of Columbus, the European laboratory of the ISS. The mock-up was a full-scale replica of the module that is actually in orbit, a sort of large aluminium can measuring 4.5 metres in diameter and similar to many others, longer or shorter, that make up the Space Station. Each one can be an independent pressure vessel, with hull and hatches capable of maintaining an internal pressure

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