TECHNOCULTURE

Space 2.0: A spacefaring species

Episode 44

Full transcript

Guest: Jennifer Ngo-Anh [Jennifer]
Host: Federica Bressan [Federica]

[Federica]: Welcome to a new episode of Technoculture. I am Federica Bressan, and today my guest is Jennifer Ngo-Anh, research coordinator at ESA, the European Space Agency. Welcome, Jennifer.

[Jennifer]: Hello, everybody. Hi, Federica. Thanks for having me.

[Federica]: During the past year, we have heard a lot about ESA's astronaut selection program. Now, the applications have closed (the deadline was June 18th, 2021; this is late July that we're taping this). What can you tell us about the selection so far, how many applications you have received, and so on?

[Jennifer]: Yeah, we were actually quite overwhelmed by the number of applications that we received. More than 22,000 people submitted an application to our ESA astronaut vacancy notice. Applications came from all member and associate member states, including Lithuania, which recently became a part of our ESA family. After 22,000 applications, more than 7,000 applicants came from France, 3,700 from Germany, and almost 200 from Italy, and almost the same number, 200, from the United Kingdom. Just for comparison, during our last call for astronauts in 2008, the number of applicants who provided a medical certificate and finalized the online application form was 8,400, thereabout. Also nice for you to know, hopefully, around 5,400 or 24% of all astronaut applicants identified as female. In 2008, that figure was 15%. And more than 200 candidates actually applied to our newly established parastronaut vacancy, which is a vacancy that was released exclusively for space enthusiasts with a certain physical disability.

[Federica]: And how many astronauts will make it? So how many are you looking for?

[Jennifer]: We're actually looking for two distinct astronaut profiles in this recruitment campaign. We're looking for traditional career astronauts, but we're also (and that is a first in the history of ESA) looking for reserve astronauts so that we're flexible as we can be to additional flight opportunities that may open up in the future. So the traditional career astronauts will be hired as permanent ESA staff members. It's the classical avenue for long-duration missions and will involve high-visibility assignments like commanding a mission or participating to extremely complex or exceptional missions — for example, the future lunar missions that we're planning for. And for this group of astronauts, we're aiming to recruit four to six candidates. Selected members of the reserve will be individuals who could potentially participate to additional missions over and above our accrued rights on board the ISS, so they could also participate to commercially provided missions or any other opportunity that ESA and/or its member states might want to take which requires sending a European into space. Once selected as a reserve astronaut, those individuals will not immediately be hired by ESA. They will rather remain with their current employer, and if a mission or opportunity arises, then those members of the reserve may then be hired on a temporary limited contract linked to the respective mission. And at the end of this contract or this term, typically about four years, they will be released from the European Astronaut Corps and will go back to their normal occupation. And our aim here is to have up to 20 people in the pool of reserve astronauts.

[Federica]: Wow, and more or less, how long is the selection process going to take?

[Jennifer]: Well, the selection process, as you might imagine, for astronauts is very complicated. They are checked from head to toe, and we expect the entire selection process to last about one and a half years. So by October or fall of next year, 2022, we expect to be able to present the new class of astronauts to the public.

[Federica]: What happened to the previous cohort? Are these new astronauts going to replace them?

[Jennifer]: Well, you know, it's our, or the agency's, responsibility to ensure that that there is a smooth transfer of knowledge from one class of astronauts to the next, and our trained and experienced astronauts will continue to be part of our Astronaut Corps, but as you might imagine, recruiting and training new astronauts takes time. It's a very complicated business, and there are many future possible opportunities that open up. For example, additional traditional ISS missions. The ISS, by the way, will operate until at least 2024, and discussions are underway to extend that up to 2028 or 2030. There may be flight opportunities arising from new partnerships like China or commercial partners, and together with our international

partners, we are working towards missions towards the moon as part of the Artemis program, which is the successor of the Apollo program. So we are currently building an ESA moon science program, and for that we will need ESA astronauts to carry it out. So there are a lot of different flight opportunities that await us, and that is why we think it is a good time now to recruit new astronauts. The new astronauts will not replace our current astronauts. Exploration is a collective effort. We need to extend the pool of talents we can rely on in order to continue to make progress in the space exploration endeavour. So the old class and the new class will work together hand in hand also in the future.

[Federica]: Yeah, I hear what you're saying. Like the astronaut is like the rock star, but these missions are collective efforts, so there are large teams required to support...

[Jennifer]: Right.

[Federica]: ...these missions. So while you are selecting the new astronauts, are you also hiring other figures at this time?

[Jennifer]: So let me explain maybe to your audience. With this call, the requirements for applicants were very traditional. They needed to have a master's degree in natural sciences, medicine, engineering, mathematics or computer sciences, with at least three years of experience, of professional experience, which could include working in a lab, conducting research in the field, or working in a hospital. We also accept applications from test pilots or test engineers from an official test pilot school. In addition to those hard and very formal requirements, there were soft skills that we were looking for. You need to be flexible. You need to be prepared to cope with frequent travels, being away from your friends and families for intensive training and preparations. So for that, it is really important to be able to work well as part of an intercultural and interdisciplinary team and, yeah, to be able to cope with unforeseen events ad hoc. But the reason for why we have been looking for astronauts with classical traditional educational and professional profiles is that they will still be pioneers for safe and sustained long-duration exploration missions into deep space, something that nobody has ever done this far, and in addition, we still want those astronauts to conduct scientific experiments, and for that, a background in one of the areas that I mentioned earlier is essential. We're doing a lot of science, and we're not supporting space tourism as a space agency.

[Federica]: How much time are these astronauts expected to spend in orbit and how much on the ground? More or less, because we always think, you know, astronauts are up in space, but there is actually a lot of work to be done on the ground also. Maybe the time spent in orbit...

[Jennifer]: Yeah.

[Federica]: . . . increases with every generation of astronauts?

[Jennifer]: Yeah. Well, the European astronauts currently join six-month duration flights aboard the space station. They perform experiments in microgravity. They operate and maintain the station's systems, so they assemble, activate and test new station elements, undertake scientific research, for example, by serving as test subjects in life science experiments, but for those missions, astronauts, of course, need to train and prepare properly, sometimes many years in advance, depending on when a flight opportunity and which flight opportunity opens up. And astronauts who are not yet assigned to missions or who have just returned from ISS missions, they provide technical support to human and robotic space exploration projects. They maintain their skills through refresher training or on-earth missions, and they undertake also a lot of public relations activities to communicate the importance of space and exploration. Our astronauts, as you might imagine, are some of the most visible ambassadors of our space program, and as such, they spend quite some time participating in outreach and education activities, engaging wide audiences, especially the younger generation, not only before and during a mission, but also afterwards. And the new class of astronauts may also be part of the new Artemis or lunar program, which aims at bringing humans to lunar orbit as well as back onto the lunar surface. And while the moon, of course, is 1,000 times farther away than the International Space Station, we do not yet know how long those missions last. We do not yet know whether those future Artemis missions will be increased compared to today's missions, to the International Space Station. That is still work in progress.

[Federica]: So you described a little bit the profile, the background, the skills that someone now needs to be able to fly to space or to the space station, but we hear a lot about space tourism and, you know, other sort of opportunities to go to space that may arise for civilians or, you know, us common human mortals, so do you see in the next future possibilities to be hired as professionals to open up in terms of tourist guides or non-scientists, you know, for these types of businesses? Not. . . I'm not asking a concrete question about next year, in two years, but since this seems to be something that is drawing closer and closer to us, do you see soon opportunities to be part of, you know, cleaning stuff or a cook up in space without being a scientist and a trained pilot?

[Jennifer]: You are making a very good reference, Federica, to space tourism, and you are very right. We will and actually are already seeing a change in population that goes into space. One changes that we can already see is an evolution from government-led space programs towards a commercial private space industry. Take, for example, Richard Branson or Jeff Bezos. Those are just two of the very recent names in space travel that have been all over the media in the recent weeks, and there are many more smaller companies ramping up their operations with scalable space travel in mind, and that means that soon we will see a change in health and

fitness of those going into space away from our currently relatively young top fit superhuman astronaut cruise to a health-wise more average, more middle-aged population. Millionaires typically do not lead very healthy lives, but with this year's ESA astronaut call, we have been focusing on traditional profiles that will still help us in conducting valuable research and testing new technologies, something that we still need to do a lot if we think about long-duration exploration missions into deep space.

[Federica]: Of course, and speaking again about the previous cohort and this one: as technology advances, I was wondering if both the training and what they actually have to do, then, for their job changed since, you know, 2008, and if you could go back in time, also. So how has the astronaut profile and job changed since the '60s and '70s?

[Jennifer]: Yeah. As you rightly say, you probably have heard or read about it and realized that human space flight is currently entering the next phase of space exploration or, in other words, the second space age has arrived. And also, you might have heard in the media that all major space agencies, including us from ESA, would like to go back to the moon. We would like to go back there not just for brief visits like in the Apollo program 50 years ago, but this time we would like to stay and work and live up there safely and sustainably, and we would like to do so through a program that our American friends have called the Artemis program. Artemis, by the way, is the twin sister of Apollo. But we do not want to go back to the moon for the pure sake of returning. We do not just want to go back there to plant a flag and quickly leave before something bad happens. No, we would like to go back there to prepare and be ready for even more challenging missions. Ultimately, we would like to go back or we would like to go to Mars with a human crew for extended periods of time. And I know all those plans sound really ambitious — and they are — but if we want to pursue those plans seriously, we really need to understand the combined effects that space and the space environment have on our astronaut crews, how those combined effects impact astronauts' health and performance and ultimately mission success, and we need to try to identify how to prevent or counteract those risks and challenges if we want to make a mission out of the vision of going to moon and Mars for extended periods of time, and that is what we do with our daily work, and that is what has changed to maybe 10, 20, or even 50 years ago, where the focus was to fundamentally understand what happens to the human body in space. Can we go into space? Is it technically feasible to go into space? And yeah, we are now using the ISS as a microgravity laboratory for fundamental research, but we're trying to move away to use the ISS to test for more challenging missions to moon, to Mars, or wherever humanity will take us.

[Federica]: Wow. For the audience, you have mentioned the ISS a number of times so far. Would you care to explain what it is, just briefly?

[Jennifer]: Well, the International Space Station is one of the most ambitious international

collaborations ever attempted. It's a convergence of science, technology and human innovation that provides us with a one-of-a-kind human, yeah, proving ground as we move forward to moon and to Mars. Since the earliest day of the space station program, scientists have studied the health of astronauts in orbit. Our human research program on board the ISS covers all body systems that are affected by the space environment. We know, for example, that with our research, we can address the issue of aging in a very structured way; astronauts on board the space station age much faster than people down on Earth. And we also study the muscle systems of our crew members because astronauts work in a weightless environment, very little muscle work is needed to move around, and as a result, their muscles atrophy and deteriorate in function. Everybody who has looked at a gym from outside knows if you don't use it, you lose it, so we all know that without regular use and exercise, muscle become became become weak and melt down, which is really something we need to counteract against, which is why we do a lot of research on the space station. We also have a biology research program on board the space station where we try to understand how space flight affects living systems in space, so through the experiments that we conduct on board the space station, we examine how plants, how animals grow, develop, mature and age. We study how organisms sense gravity, how they repair cellular damage and how they adapt to the conditions of space and the space environment, and we do it across the entire spectrum of biological organization, from molecules to cells, from tissues to organs, and from systems to whole organisms. And then just for completeness, our activities also cover physical sciences research, so we are running quite a lot of experiments from the material and fluid physics area on metals, plasma, fluids, and even textiles in space looking at how materials behave and perform in the space environment with the vision of finding or creating novel materials.

[Federica]: All right. So I was just going to ask you about the science that is conducted up in space right now, because it's not all research related to further space exploration. Much of that has an application on Earth. You have mentioned the disciplines, the fields of science. Is there maybe some example that you could give about some specific experiment or study on something related, I don't know, climate change or some type of textile that serves on Earth, or drugs that could be used for human health on Earth?

[Jennifer]: Well, it will for sure not come as a surprise to you when I tell you that the space environment does not really offer condition for which we humans were made for. Space is actually quite a hostile and unforgiving environment for humans, if you think about it. And just to illustrate which effects space flight has on the human body, and why we do a lot of research on board the space station, a six-month stay in orbit reduces bone density by the equivalent of 10 years on Earth. Astronauts lose on average 37% of muscle mass during the first seven days in orbit, and physical work capacity is reduced by 40%. Of course, not all astronauts are affected, but quite many, and in addition, space and the space environment exposes astronauts to increased cosmic radiation, which leads to increased risk for cancer, and all those very

extreme conditions have direct impact on the feasibility and the success of the long-duration crewed missions that we're currently planning towards. And all those extreme conditions are what we address with our research activities on board the space station. So you can summarize and simplify it with one central question. With the research that we do on board the space station, we're wondering, how can we make humans a space-faring species, how we can we contribute to make missions beyond low Earth orbit with a human crew a safe reality, and how can we preserve health and safety of our crew members over the entire lifetime of the crew? So that is the central question of our research program, and that is what we do on a daily basis.

[Federica]: Thank you for giving some of those figures, because we sometimes do hear, yes, you age faster in space, but how faster? That is quite striking, actually, about bone density, and I assume you monitor the astronauts while they are in space and then when they come back to Earth, they also undergo like a period of monitoring, probably.

[Jennifer]: Yes. Yeah, that is correct. We assign flight surgeons to every crew preparing for a space mission, so those doctors are responsible then for the astronauts' healthcare and medical evaluations and training before, during, and after space flight. And during the mission, the flight surgeons, they work in the mission control centre and communicate with the astronauts each week. They treat both astronauts in the air, and also their friends and family on the ground, often making house calls. Flight surgeons also travel to launch and landing sites to offer medical support, so yes, they are monitored not only while they are on orbit, but also before and after.

[Federica]: Your background is in medicine and the neurosciences, so I will ask a follow-up question on the astronauts' health again, and that is, is the response really subjective? You said not all respond equally — that's to be expected — but is there a great variety in the response?

[Jennifer]: Yeah, there are individual differences between astronauts. That is human, that is natural, and that is why the data that we collect from those crew members when they are on board the space station are only valuable if we compare them to normal baseline or ground reference data, and we usually repeat the same experiment on multiple crew members to iron out individual differences.

[Federica]: In the light of all we have said, would you say then that besides being so appealing and sexy as a career opportunity, is it still a high-risk career?

[Jennifer]: It is a high risk, but yeah, no risk, no fun. I don't think that any of our astronauts shy away from the flight opportunity. I think you can learn, you can gain a lot from going into space. We have heard just recently from also Richard Branson and Jeff Bezos that,

yeah, it changes their view on life on Earth. So yeah, I'm convinced that space station research and missions into space are very valuable.

[Federica]: Well, my personal take on that is that for some of us, it shouldn't take a space journey to realize that the planet is fragile and to care about certain things like the environment, etc., but certainly I would like to go around Earth once or maybe, hey, on a honeymoon to space. That's super nice. You have stressed how all of this is a collaborative effort, like large teams and many countries coming together not just at European level for ESA, but on a global scale, of course. So I would like to ask you, how do you think this works so well when we see so much friction sometimes and at political level among these countries? If you have an idea of why this seems to be working for space exploration, because it's so inspiring. It's such a positive message that countries, nations, can come together and cooperate swimmingly to achieve this, global goals. Like the ISS is an example of this.

[Jennifer]: Yeah, absolutely. So yeah, space unites us. In space, there are no borders. The International Space Station is a wonderful example of what is possible on an international level across many borders if you just want to. There are no borders inside the ISS either, even if it officially consists of a Russian and an American part. By April of this year, 244 people from 19 countries have visited the International Space Station, and one reason for why I am and why I was drawn to ESA is because I like the international collaboration aspect of this project. Every country is so different and has its specific identity and priorities, but in the space area, everybody is working together towards one shared ideal, and if we ever manage to leave our planet and explore deep space, it will be because we will have been able to set aside our nationalistic interests in favor of a shared vision.

[Federica]: And if you let me tie back to the parastronaut program that you mentioned before, which reflects, clearly, the values of a society — inclusivity — provided that everyone can give a contribution to the space mission, and this is the first program of its kind, would you like to say two more words about it? What kind of disabilities, and what kind of other requirements they still need to meet to apply.

[Jennifer]: So well, the ESA parastronaut initiative is a pilot project. So we were, or we have been looking for, individuals who are psychologically, cognitively, technically, and professionally qualified to be an astronaut, but have a physical disability that would normally prevent them from being selected, but we are ready to invest in the necessary adaptations of space hardware to enable that those otherwise excellently qualified professionals can serve as crew members to future missions. There are many unknowns ahead of us. The only promise that we can make today is the one that we are seriously, dedicatedly, and very honestly attempting to clear the path to space for an astronaut that would normally not be able to fly, and along the way we expect that the parastronaut project will bring innovations and other benefits to safety and

efficiency of future crew members. So we hope to also learn a lot in that through that project and along the way.

[Federica]: On a closing note, we all see how these things are going to happen. It's, of course, not easy, but it seems just a matter of time that we'll go back to the moon to stay, etc., and it's just so funny that we almost couldn't get Zoom to work at the beginning of this conversation. How is that possible? [laughs]

[Jennifer]: But that's, to the audience, that's because I'm not very clever when it comes to IT.

[Federica]: Oh, no, no, that can't be. No.

[Jennifer]: Totally not Federica's fault.

[Federica]: Oh, no, no. That can't be. It's just, the technology does not collaborate. Anyway, they don't use Zoom to talk to astronauts on the ISS, do they?

[Jennifer]: No, they use a direct sort of phone link to talk and stay in touch with our astronauts.

[Federica]: Very well. Thank you so much for your time today. You shared so much information, so, so interesting, and all the best of luck to all the applicants that applied and through the selection process in the next years. Maybe one last question, which is, about the selection process, how it was advertised. It seemed to want to encourage as many people as possible to apply. Apply, apply, apply. If you have a doubt that you may be fit or not, try and check; apply. You were really calling for as many people as possible to apply, and you said the response has been huge because it was more than two-fold what you had last time. I was just wondering, you know, since the selected, the selection process takes lots of resources, etc., and many people may not have the clearest idea of what they're getting themselves into in such career, why were you so open to draw in so many people? Weren't you afraid that you would be getting a lot of noise, or how... What was the rationale behind that type of advertisement?

[Jennifer]: There was one risk that we were aware of. We, of course, knew that through our very intense promotion campaign, we would also attract a lot of applications from candidates who are not yet qualified, but yeah, that didn't scare us away. We did promote the call because we are looking for a very broad and diverse pool of talents. We're not focusing on one specific type of character, one specific type of profile, and we have been able to show in the past through our experience on board the space station that crew members and crews actually work best together when they can draw from a very diverse pool of qualifications and talents. And we

hope that this will also be reflected in the pool of astronauts that we are now selecting for the new class of astronauts. We will narrow the pool down. It will be tough, it will be challenging, but we're taking it step by step, and we are convinced that by the end of next year, we will have a new, nice, very qualified, and enthusiastic and passionate class of astronauts for our future missions.

[Federica]: Thank you. That's very nice to bring this home, stressing the values behind this large-scale human endeavor, collaboration, the international dimension, inclusivity and that you get more out of diversity, diverse pool of talents, not just one narrow profile of the superhuman astronaut we all have in mind. That's all very nice. Thank you for this nice conversation, and hope to speak to you again one day.

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