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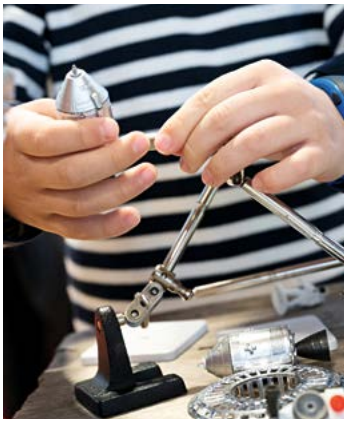
CNESMAG

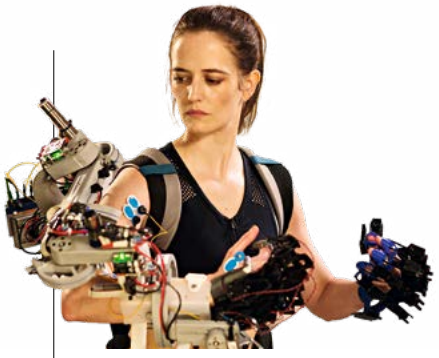
#96 SPRING 2025

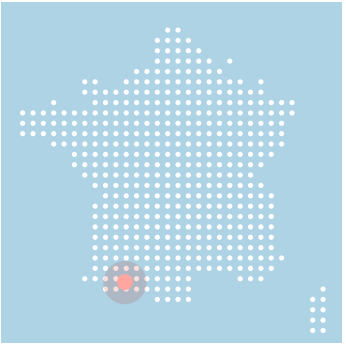
Making space for youth

Launchpad

#96 — SPRING 2025







To read the magazine on line

Crew

Evelyne Cortiade-Marché

Evelyne Cortiade has had the opportunity to explore a range of jobs and disciplines in a rich and rewarding career with CNES spanning 24 years. Today, as head of Youth Education within the agency's Communication Directorate, she sees space as a catalyst for future careers. Driven by the desire to pass on her knowledge to younger generations, she gets a lot of satisfaction out of watching the wonder light up in their eyes.

Marie-José Gauthier

As Space Officer for French Guiana at CNES since 2020 at the Guiana Space Centre, Marie-José Gauthier has served the region for many years. Supporting education in the broadest sense and in partnership with the University of French Guiana, the local education authority and a range of other local stakeholders, her team develops training courses, funding and technical support solutions—everything that space can contribute besides launch activities to the home of Europe's spaceport.

Sandrine Ellero

Sandrine Ellero has held a variety of posts since joining CNES as an assistant in 2013, and that's precisely what motivates her. As Employer Branding Officer at the Human Resources Directorate, today she's striving to make the agency a great place to work. Her involvement in the Rêve de Gosses (Childhood Dreams) project remains etched in her memory. In this issue of CNESMAG, she shares her sense of wonderment at youngsters' curiosity for space at student careers fairs and during ninth-grade work experience placements.

Laurent Deroin

An electronics engineer from ENSEIRB, the Bordeaux Graduate School in Electronics, Computer Science, Telecommunications, Mathematics and Mechanics, Laurent Deroin joined CNES in 2012. Ten years later, this change management specialist moved to the French space agency's Strategy Directorate to shape its higher education policy. His aim is to forge closer ties with academia at a time of increasing social challenges, to develop critical skills for the future—in a word, to help younger generations achieve their space dreams.

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Horizons

“Engaging younger generations is a core CNES mission”

Marie-Claude Salomé
Director of communication

Ever since its inception in 1961, CNES has seen young generations as the future not only of humankind, but also of space and science in general. This issue is integral to the missions entrusted to our agency for several decades now, and we are in it for the long term.

Youth outreach is a strong marker of CNES’s positioning as a government agency within our ecosystem. Our actions in this domain are closely shaped by the nation’s priorities, through our longstanding collaboration with the Ministry of Education, Higher Education and Research.

This commitment is reflected in our outreach operations, work experience placements for ninth-graders, careers fairs, study grants, teacher training and summer schools. In each case, our aim is to get CNES on youngsters’ radar and give them the opportunity to meet our dedicated people.

Today, we are looking to extend the scope of our youth outreach actions nationwide, strive to achieve a more inclusive education policy, step up education for sustainable development and make careers in space more attractive to young people.

I can think of no better way to begin 2025 and open a new chapter of CNESMAG together than this commitment to our common future. I hope you enjoy the pages of this new editorial and space adventure.

PARTNERS

In this issue:
Novespace p.10; MEDES p.13; Toulouse Capitole, Toulouse Business School, Thales Alenia Space and Airbus Defence & Space, Paris-Saclay University, Toulouse University p.20; Toulouse, French Guiana and Paris education authorities p.23-24; Ministry of Education p.25; Culturespaces Studio p.29; Pirouette Cacahouete p.34; Editions Privat p.34-35; World Game studio p.35.

Space techniques in young hands

Last October, for France's 24th Science Week, CNES put on a packed programme of events focusing on ocean-related science to reflect the national theme for 2024. These included meet-ups, conferences, on-line challenges and numerous other special activities and workshops for youngsters.

More than 2,200 m² of space experiments for young and old

After a three-year design phase and two years in construction, the former Space Museum at the Guiana Space Centre has been reborn under the name Guyaspace Expérience. The new venue offers visitors an immersive experience that is both fun and educational, with interactive games, videos, workshops, hands-on models and more—everything to see and feel what it's like to be an engineer, a technician or even a satellite, for anyone from 3 to 103.

Exceptional flight for special children

Last spring, 135 children with special educational needs discovered space and ten got the chance to embark on a parabolic flight on the Zero-G aircraft operated by Novespace in partnership with CNES. This unforgettable experience marked the high point of the Toulouse stage of the Rêves de Gosses (Childhood Dreams) outreach project led by the eponymous non-profit association.

Feet in the city, head in space

With virtual exploration experiences, workshops to build a water rocket or Mars rover, and pool training like an astronaut, last year's Space in my City tour, organized in partnership with non-profit association Planète Sciences, once again hit the road to bring fun science activities on the theme of space to 3,146 youngsters in priority neighbourhoods across France. In 2025, after 19 years, this popular outreach operation is getting a revamp.

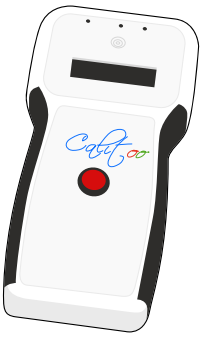
Secondary school pupils in weightlessness

The countdown has started for ten pupils from the Lycée Français in Lomé, Togo, laureates of the Parabole Lycées 2025 operation. This March, they will be conducting microgravity experiments conceived for CNES's educational project at Novespace's facility in Bordeaux, where they'll also meet up with the two other winning teams from Nîmes and Avesnes-sur-Helpe in France. Two members of each team will be tasked with performing their experiments on a parabolic flight of the Airbus A310-Zero G operated by Novespace, with support on the ground from their classmates in designing the tests and exploiting results.

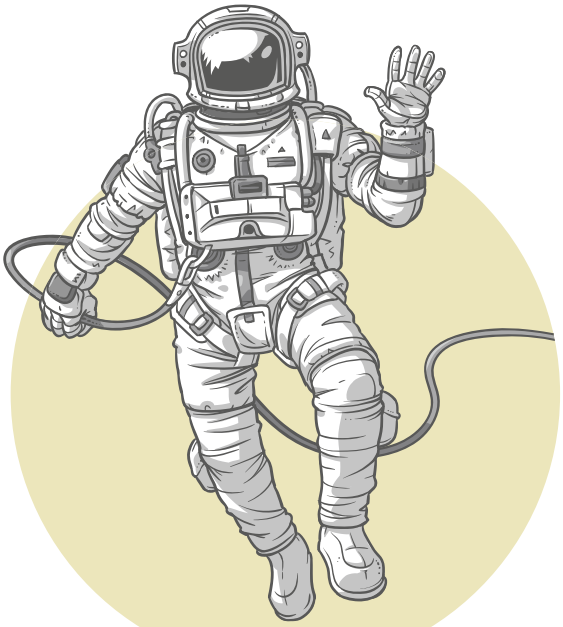
Space for youngsters in priority neighbourhoods

In 2025, CNES is revamping its Space in my City and Spatiobus initiatives with the launch of a new Spatiothèque space library. Roving "out-of-the-box" workshops take science and engineering culture notably to youngsters in priority neighbourhoods during their school holidays.

Argonautica and Calisph'air set sail



In recent editions of the Vendée Globe solo round-the-world yacht race, skippers have been aiding science by taking with them a range of instruments—transmitters, buoys, sensors and weather stations—to collect data for researchers. For this year's race, two of the instruments supplied by CNES also helped to spark youngsters' scientific curiosity. Five yachts departed from Les Sables-d'Olonne with Calitoo photometers (see p. 28/ Constellation) for the Calisph'Air educational project focused on studying atmospheric pollution. Two skippers also released Argos Marget II transmitters for the Argonautica programme to enable more than 500 classes to study the oceans and marine animals using satellite data.



Astronaut for a Day gets underway

This year, CNES is launching a new outreach adventure called Astronaut for a Day, giving eighth-grade pupils the opportunity to step into the shoes of aspiring astronauts. They'll be subjected to a series of scientific, logic and sporting tests, offering the chance to experience the unique conditions of microgravity during a parabolic flight on board the Airbus A310 Zero-G operated by Novespace.

Work experience in ninth grade

From 10 to 14 February, CNES played host to some 150 work experience interns, offering them a packed programme of visits, activities and meet-ups. This year the agency's balloon base in Aire-sur-l'Adour will be joining this initiative alongside its field centres in Toulouse, Kourou and Paris.

20 years

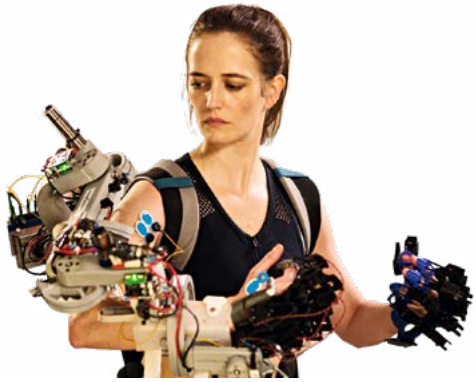
and two flights for PERSEUS

The PERSEUS student space research programme has been promoting career paths and entrepreneurship in the field of space transportation through educational and industrial space projects since 2005. This year, 300 young students will be joining the adventure, with seven key projects converging in the long term towards an eco-designed demonstrator of a reusable sounding rocket.
To mark its 20th anniversary, PERSEUS will be conducting two flights: in May, the Serendipity rocket will launch from Kiruna in Sweden, followed in July by Stork 3 at the next C'Space student space project event in Tarbes.
This demonstrator designed by the ICAM engineering school in Strasbourg will be carrying a test autonomous guided parafoil system of the kind needed to bring rockets back to Earth, to study its behaviour and settings.

End of the road for CASAA-Sat

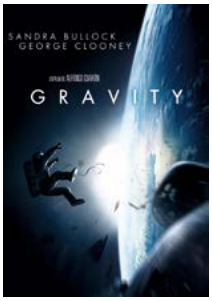
On 26 December 2024, the Kinetica launcher lifted off from the Jiuquan space base in China carrying the CASAA-Sat nanosatellite developed by the CSU university space centre and the LAM astrophysics laboratory in Marseille for the Nanolab Academy programme (see p. 26). The launcher's third stage failed and the mission was lost. It nevertheless remains a huge learning success for all of the students involved.

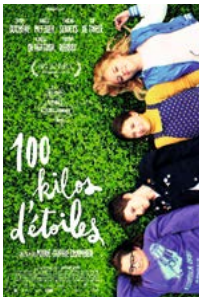
Female conquerors of space and screen



Long eclipsed in space films, women are finally taking the lead roles in our cosmic imaginings. From *Gravity* to *Proxima* and *Stars by the Pound*, striking heroines are shattering stereotypes and inspiring a new generation.

Since 1902 and *A Trip to the Moon* directed by Georges Méliès, the space film genre has thrived, inspiring dozens of moviemakers to explore all manner of stories, mixing scientific realism, intergalactic adventures, alien invasions and deep reflection on man's place in the universe. Yes, you read that right: *man's* place. Because women have been notably absent from the genre. Yet it all started so well. When Fritz Lang made his 1929 silent film





Woman in the Moon, he cast a female in the vital role of engineer on the lunar expedition. But in the decades thereafter, women were sidelined, featuring only as the archetypal 'damsel in distress' or 'femme fatale'. The space sci-fi subgenre was a little more open, with female characters in such leading roles as Princess Leia in *Star Wars* (George Lucas, 1977), Ellen Ripley in *Alien* (Ridley Scott, 1979) and Dr Eleanor "Ellie" Arroway in *Contact* (Robert Zemeckis, 1997).

But to find women at the controls in more realistic space movies, we had to wait almost two decades.

A new breed of heroines

The first to burst onto our screens was medical engineer Dr Ryan Stone. In *Gravity* (Alfonso Cuarón, 2013), she survives a space debris storm thanks to her resilience and inner strength, with no male alter ego to come to her aid.

The vacuum of space then becomes a metaphor for her eventual rebirth. The next year, audiences discovered *Interstellar* (Christopher Nolan, 2014) with its two strong female characters: astronaut Dr Amelia Brand and Dr Murphy "Murph" Cooper, the astrophysicist who would save humanity. Another notable mention goes to *Hidden Figures* (Theodore Melfi, 2016), which tells the true story of three female African-American mathematicians who worked on NASA's space programme, a stark reminder that the world of science is no stranger to systemic discrimination.

A French take

Contemporary French cinema, while less prolific on the space front, offers some original and intimate approaches. *Proxima* (Alice Winocour, 2019) tackles the conflict between career and family through its portrayal of a young astronaut torn between her mission and her daughter. Filmed in partnership with CNES, *100 kilos d'étoiles* (Marie-Sophie Chambon, 2019) follows Loïs, a teenager with a complex about her weight, who dreams of space despite the discrimination against those who don't fit the established norms. Like Ryan and Murph before her, Loïs takes on the infamous glass ceiling, paving the way for new portrayals. After all, if the universe is infinite, why shouldn't the possibilities for women be?

Q&A

Guillemette Gauquelin-Koch,
HEAD OF LIFE SCIENCES AT CNES

"In space, men and women are equal"

Do women have a role in space?

Absolutely! Valentina Tereshkova proved it 51 years ago. However, women are still underrepresented in space missions, accounting for just 11% of astronauts. In ESA's last recruitment drive, they represented barely 10% of applicants in the final phase. But it's worth noting that France fielded 1,644 female candidates in this selection process. That's more than any other country!

Are the physiological constraints of space different for women?

The only notable difference is its impact on the menstrual cycle and hormonal system. Currently, female astronauts can suppress their menstrual cycles for a few months. However, future Mars missions lasting two or three years will bring new challenges.

Are studies being done into how space affects women?

In France, the MEDES space clinic is exploring these issues to improve living conditions for female astronauts on long missions. After an initial study of 12 women confined to bed for 60 days, new research was carried out in 2021 on volunteers placed in dry immersion for five days. This work shows that, hormonal issues aside, men and women are basically equal in space.

MATHIEU **VIDARD**

Journalist, presenter, producer and author

“Science can instil a sense of wonderment”

Faced with the rising tide of fake news and the questioning of scientific consensus, Mathieu Vidard emphasizes the need to give youngsters the taste for science from an early age. For this science communicator, a real-world and human approach to popularizing science is what’s needed.

How have young people's attitudes to science changed?

Today, younger generations are increasingly exposed to scientific content through social media and YouTube. That's a great thing of course, because these platforms give science a much higher profile, making it more accessible and attractive, with frequently more dynamic, bite-sized and visual formats. All of this content supports science, but alongside the reliable sources in this glut of information there's also a lot of pseudo-science out there. A whole host of flat-Earth and climate-sceptic movements are proliferating on TikTok and YouTube, both platforms that are hugely popular with younger generations, some of whom aren't sufficiently armed to think critically and identify them as such. Such conspiracy theories represent a real danger. Another noticeable shift is that a lot of young people relate to science through social issues, which maybe reflects a change in the way it's perceived. Science is no longer seen as an abstract discipline, but rather as a very concrete solution to the challenges posed by climate change or the need to preserve biodiversity.

How can we reach those who stray from science?

I think getting youngsters interested in science at school is vital. That's where it all has to start, cultivating certain notions and ways of studying scientific methods, and grasping the importance of learning to think critically. Science leaves room for discussion, it's not an unchanging truth; quite the opposite, scientists are forever questioning their own findings and conclusions. All of this must percolate through from an early age. That means illustrating science not only through theories, but also with lots of hands-on learning in the field to make it appealing.

"Science is no longer seen as an abstract discipline"

Do we need to remain children at heart to like science?

There's no age to cultivate curiosity. We can marvel at science from 5 to 90 and nurture our desire to understand the world around us. Simple science questions aren't just for children; they're the kind of questions all lay people ask. I don't think we should be afraid to ask or not understand them. And for that, we need good educators. For those of us who've dreamed about science or developed an interest in it, I think it's something we never lose.

What role does CNES have to play in science outreach?

An institution like CNES has a key role conveying the results of scientific research to the lay public, particularly younger generations. It's already engaged in making science living, accessible and attractive. It shows the real-world applications of its missions through educational workshops on Earth observation, school competitions like CGénial, Science Week and hackathons. We also need to use new media like educational mini-series on YouTube to go behind the scenes of the world of space, launchers, the lives of astronauts or the applications of satellites in our everyday lives. Collaborations with science influencers like Bruce Benamran or channels like Scilabus can also help to reach a wide audience.

2006-today
Presenter of *La Tête au carré* radio show on France Inter, then, from 2019, *La Terre au carré*

2016
Publishes *Carnet scientifique* (Science notes)

2017-today
Presenter of *Science grand format* TV show on France 5

2021
Awarded Science Education Medal of CNRS, the national scientific research centre

"Works of fiction can entertain and educate"

Are environmental issues a good place to start?

The environment is a very federating theme for younger generations. CNES can explain how satellites are keeping track of deforestation in the Amazon, how the ice caps are melting and highlight how technologies are supporting efforts to tackle climate change. There's also the European Union's Copernicus programme, to which CNES is contributing through its satellite data, which is showing how we can anticipate natural disasters or how temperatures are rising all over the globe. It's another way of linking science to real-world social issues and CNES has a very active part to play in that. These applications show youngsters that science isn't just a theory; it's also of practical value in our daily lives.

What's your view of fiction as a means of transmitting knowledge?

Fiction is a fundamental gateway. For me, Jules Verne was an emblematic example. I think he inspired generations of future scientists and engineers, because he succeeded in melding exploration with discovery. I could also mention movies like *Interstellar* or *The Martian*, which deal with black holes or life on Mars and have a very broad appeal. On TV, the Cosmos series with astrophysicist Neil deGrasse Tyson has succeeded in combining fictional tales and scientific explanations. So works of fiction can entertain, educate and spark interest in science, while transforming concepts that may sometimes appear a little tedious into compelling and relatable storytelling. Our imagination and fiction are absolutely vital to sustaining scientific research. Jules Verne proved that science can be an adventure and a source of wonderment, fuelling desires and even inspiring vocations.

Pointers

Two space classes in French Guiana

It all started with the junior high and high schools in the Toulouse education authority's space network and Albert Camus junior high in La Norville, south of Paris. But the club of schools where space is a central feature of the curriculum recently welcomed a new member into the fold, with the opening of two new space classes at Paul Kapel junior high in Cayenne. Starting next September, pupils will be offered optional supplemental maths lessons and a space workshop centred on activities and visits. Ultimately, the school is seeking Science and Space accreditation.

10

MILLIONS EUROS

Total in grants awarded by CNES to 140 PhD students and postdocs in 2024. In a departure from the usual co-funding procedures, nine students were funded 100% by CNES under an experimental arrangement initiated in 2023 for highly future-oriented research.

"School careers fairs are very popular with students looking to identify possible career paths where CNES's booth is always a big attraction. For the 2024-2025 school year, CNES will be on hand at 24 events involving more than 50 people from human resources and engineering disciplines—a record that underlines our agency's desire to get out and meet tomorrow's talents."

Sandrine Ellero,
CNES EMPLOYER BRANDING OFFICER

Space in their sights: CNES engaging young generations

Be it through outreach workshops or training for educators, CNES is working more than ever before to inspire scientific vocations and reveal new space talents. By strengthening education policy and forging strategic higher education partnerships, the agency is readying a new generation to take up the challenges ahead.

Nurturing tomorrow's talents

With the future of strategic sectors hinging on our ability to discover and train new talents, CNES is strengthening its educational policy through inclusivity, sustainable development and the attractiveness of careers in space.

Negative views of science and waning interest in science and technology subjects, added to persistent gender stereotyping, are just some of the factors that in recent years have made the challenges already facing many strategic areas of activity even more acute. What future is there for French scientific excellence if youngsters don't believe in it anymore? What will become of medicine, ecology, artificial intelligence and space if tomorrow's talents desert these disciplines? More than ever, it appears vital that CNES should engage future citizens in response to this threat.

Education for everyone, everywhere

"Education and outreach has always been one of CNES's public interest missions," affirms Séverine Klein, Deputy Director of Communication. "In fact, it's a requirement of our objectives and performance contract with the government. But to meet the challenges facing us today, we want to step our efforts up another gear." In 2022, to execute this mission more effectively, the agency reshaped its education policy around several ambitions. "The first ambition is to extend the scope of our actions nationwide," says Evelyne Cortiade, who heads CNES's Youth Education department. "That will involve, among other things, more web conferences, closer ties between the Guiana Space Centre and Guianese youth and, in the near future, a new space library to distribute teaching kits all over France." This initiative is also fuelling the second ambition centred on

The Argonimaux education project, part of the Argonautica programme, gets youngsters studying the marine environment and the climate with satellite data. Jean Moulin primary school, Montrabé.

fostering inclusivity in space careers and combating bias and stereotypes with regard to gender, social origin or disability. "The last two ambitions concern education for sustainable development and the attractiveness of space careers," adds Cortiade. They're being pursued through a number of outreach projects engaging youngsters like Climate Detectives or Argonautica. But to attract their attention, CNES is above all exploring new avenues ranging from classroom resources to fun products on sale to the wider public like games, manga or digital content (see pp. 34-35).

Two forward-looking chairs

CNES is confirming its commitment to higher education and its multidisciplinary vision through two chairs of excellence. The Space chair at the ENS-PSL engineering school, inaugurated in February last year, analyses the cultural, geostrategic and environmental stakes of space. And the Sirius chair, renewed last June, explores the legal and economic dimensions of the space sector with its partners Toulouse Capitole, Toulouse Business School, Thales Alenia Space and Airbus Defence & Space.

33%

of young people

believe science does more good than harm, versus 55% 50 years ago

Survey by IFOP/Fondation Jean Jaurès, January 2023.

"The work we've been doing also shows that we need to offer novel initiatives with a broad appeal to lend greater visibility to our actions, which are already extensive but not well known," says Séverine Klein. "In 2025, we'll be making two additions to our toolbox with the Astronaut for a Day challenge (see p. 11) and our very first Youth Education Festival (see p. 35) that will showcase all of the educators, youngsters and mediators involved in our educational projects, while also taking our youth activities to a wider audience."

Training future space experts

The agency's youth actions aren't restricted to secondary schools. "We're aligned with the main thrust of CNES's education policy," explains Laurent Deroin, in charge of higher education. "In the higher education sphere, we're always looking to sustain scientific excellence and promote space expertise and jobs from a career-based perspective, combining training and research." In practice, this approach involves fostering close collaboration with universities, engineering and business schools, university space centres and regional authorities. But it also includes key student space programmes like Perseus and Nanolab Academy, as well as outreach efforts like Universpace summer schools.

"In 2025, we want to continue shaping a dedicated policy," adds Laurent Deroin. "CNES is also opening a new chapter in its relations with the world of higher education through two projects that have obtained the seal of approval of the government's France 2030 plan: the Ile-de-France Space Academy run by Paris Saclay University and the Comètes programme at the University of Toulouse, both focused on devising innovative learning paths for the space engineers of the future."

Space in the feminine plural

Inspiring vocations and offering stronger career prospects for women in its engineering teams, CNES is working to improve its gender mix and performance.

39%

Proportion of women
at CNES, 30% engineers and 33% managers.

CNES has shown itself an early achiever in raising the proportion of women in its workforce and deconstructing gender stereotypes. "Since 2018, our partnership with the Elles bougent non-profit association has enrolled more than 90 female 'patrons' at the agency to talk about their experiences in primary, junior high, high schools and higher education institutions to give young girls real-life models they can identify with," says CNES school projects officer Angélique Gaudel. Site visits, scientific workshops and theme days in Toulouse augment these efforts to get girls interested in space and explore the opportunities that science and technology subjects offer. In the same vein, albeit at another scale, CNES is also partnering a competition to further careers for women in aerospace with the Airemploi

Seven young girls from Pardailhan secondary school in Auch visit the Toulouse Space Centre as part of the Airemploi competition designed to boost careers in aerospace for women.

association. Every two years, the agency's Toulouse Space Centre opens its doors to a group of eight high-school girls from priority neighbourhoods or rural areas, with a half-day of visits and talks with employees. The girls produce a video and a news sheet as they compete for the opportunity to present their work at the Paris Air Show.

CNES is also deploying a strategy to foster gender equality. Five agency-wide agreements addressing this issue have succeeded one another over the last 20 years, making significant progress in the proportion of women in the workforce, career advancement, pay and the work environment. Looking further ahead, the agency's human resources directorate is engaging a range of actions, including leadership training and networking support, by paying for subscriptions to female professional networks like the Women in Aerospace association. From initial inspiration at school through to career development, CNES is working to break through glass ceilings and open the space sector to all.

Putting CNES on the map

CNES has been working to boost its employer branding since 2022. One of the aims of this effort is to inspire more vocations among young women. Attendance at shows and forums, promotion of women's profiles and partnerships are just some of the many initiatives designed to build the agency's reputation as a great place to work, where diversity is seen as a strength. CNES is also exploiting surveys among its interns, work-study students and new hires to better define the scope of its actions and drive improvement.

In 2023, the Space in my City tour called into ten cities around France. For five days, workshops gave youngsters their first taste of science culture.

MORE THAN
100,000
YOUNGSTERS
reached since 2005 through the Space in my City operation

If you don't come to space, space will come to you

From priority neighbourhoods in mainland France to the banks of remote rivers in French Guiana, CNES programmes are aimed at all young audiences, through a strategy combining proximity and scientific ambition.

CNES's youth outreach strategy all starts where the agency has facilities, while also building bridges with its target audiences. Since 2010, the Espace c'est classe (Space is class) operation, organized in partnership with the Toulouse, French Guiana and Paris education authorities, has been sending CNES employees into classrooms from primary school to final-year high school to share their experience in the space industry. In 2022, the initiative was extended with a new Web conference format that breaks down geographical barriers. Three times a year, more than 1,000 pupils from all over France log on for live chats with space experts and go behind the scenes of ongoing missions.
The agency also pursues dedicated actions for children in priority neighbourhoods. For 19 years, the Space in my City operation gave 8-to-14-year-olds the chance to get hands-on with science on their doorstep at workshops during the school holidays.

In 2025, this initiative will be succeeded by the Spatiothèque space library, offering a more agile and accessible format. The aim is to provide roving teaching kits and activities that can be organized on request for towns and cities, with "out-of-the-box" workshops lasting a few hours to a few days.
In French Guiana, where nearly half the population is under the age of 25, the Guiana Space Centre (CSG) is also forging close ties with youngsters. Thanks to an agreement with the local education authority, school children in fourth and eighth grades are invited to the launch base to see for themselves the range of jobs and infrastructures, how it operates and how it protects natural areas. Workshops are also organized in class over one and a half days, where pupils get to build micro-rockets under the supervision of CSG people and their teachers prior to a launch. Support for Guianese youth also comes in the form of funding, notably through 27 study grants every year to high-school graduates or agreements with local authorities to promote science and space culture outside school hours.

"Since 2022, CNES has been working with the French Guiana education authority and a range of partners to connect junior high school pupils in remote villages to their school via a satellite link. This logistically complex project enables sixth- and seventh-grade pupils to follow lessons live from their community, the aim being to prevent them dropping out. The project has already spawned three connected classrooms in villages far from Maripasoula and is set to be extended to other areas in the months ahead."

Marie-José Gauthier,
SPACE OFFICER FOR FRENCH GUIANA

Visit to Talhuen at the start of the 2023 school year with the Connecting French Guiana initiative.

Continuing our collaboration with schools and universities

Ever since the 1960s, CNES has been working with schools and universities to get youngsters inspired by science and space. "This partnership involves training tailored to teachers (see box), federating educational projects like Argonautica and Proximars, and a wide range of teaching materials," says life and Earth sciences teacher and CNES educator Pierre Ferrand.
Created in 2018 with the Ministry for Higher Education, the GeoImage website is the flagship of this collaboration. Using imagery from satellites like Pleiades and Sentinel, it offers science packs put together by teachers and subject matter experts. More than 400 such packs are currently on line, allowing visitors to the website to explore territories and issues as diverse as changing urban landscapes, geostrategic risk analysis or the impacts of climate change. And navigating this huge corpus of knowledge is now a more intuitive experience than ever before.
CNES is also working with the Maisons pour la Science (Science Centres) network, co-led by education authorities and universities, and supported by the French Academy of Sciences. The agency offers practical courses for primary and secondary school teachers with the scientific and industrial community. In French Guiana, it also organizes tours of the Guiana Space Centre for teachers.

Educating educators

Under its partnership with the Ministry of Education, CNES offers teachers deep-dive discovery courses in space science and technologies. Every two years, Space Education summer schools would bring together hundreds of teachers for five days of conferences, workshops and visits in Toulouse. These summer schools are currently being revamped to incorporate virtual learning technologies. Distance-learning courses are also provided throughout the year on the Ministry of Education's M@gistère platform and on the Fun MOOC platform.

Nanolab Academy fledging future talents

What if nanosatellites could serve as a stepping stone for a new generation of engineers? With Nanolab Academy, CNES is taking the approach of giving students an early taste of working in the space industry to better meet the challenges of today and tomorrow.

KEY MILESTONES

2012
Janus programme initiated

2017
Launch of X-Cubesat, the first Janus-built nanosatellite

End-2019
Launch of EyeSat (re-entered atmosphere in November 2023)

2019
Janus changes name to Nanolab Academy

2024
Seed platform rolled out

Nanolab Academy—formerly Janus—was born in 2012, a CNES initiative to address growing nanosatellite challenges while inspiring a new generation of engineers and scientists. "Its aim was to build bridges between the worlds of academia, industry and institutions, making fresh young talents central to our dual ambition of transmitting cutting-edge know-how and sparking enthusiasm for space," says Nicolas Verdier, the programme's leader.

The scope of Nanolab Academy's actions is twofold. First, CNES drafts students—interns, work-study and PhD students—into its teams and puts them to work on a large-scale nanosatellite pilot project. In all, 250 young students have contributed to the successful EyeSat programme launched in 2019 and 60 are now working on AeroSat, expected to be ready in 2026.

Second, Nanolab Academy supports nanosatellite projects at university space centres (CSUs). "A new milestone was reached this year with the Seed platform, which offers a standard nanosatellite architecture", says Verdier. At stake: help CSU teams focus on the specific aspects of their project by streamlining efforts and strengthening their skills.

Since being initiated, Nanolab Academy has welcomed some 1,500 young students on 15 nanosatellite missions into its fold. But numbers aside, its impact on the ecosystem is significant. At the end of their project, students are ready to enter the industry or launch their own initiatives. "By 2026, Nanolab Academy expects to transition to a new model, most likely with fewer but more ambitious team-based missions," concludes Nicolas Verdier.

Talking ethics

Jacques Arnould
Science historian and theologian, CNES ethics officer

Childhood dreams

When space inspires children's dreams, it helps them understand the world today, so they can build their own future.

Austrian virtuoso pianist Artur Schnabel said of Mozart's so-called 'easy' sonata, a piece well known to music lovers and aspiring players alike: "It's too difficult for adults and too easy for children". Was he thinking of the uninhibited way younger players often approach a piece, resulting in an honest or even brilliant interpretation?

And it's not just music. As we know, children tend to see their relationship with the world around them and the passage of time in the same uncomplicated way. It's beyond the scope of this column—and my expertise—to attempt any further analysis of the singular power of childhood and youth. But let me share a few thoughts on what it might mean for space.

The beauty, emotional resonance and symbolism of the sky, the wealth and variety of literary works it has inspired since the 17th century and the images accompanying space exploration since the mid-20th century clearly tell us that space and interplanetary travel continue to fire our imagination. After all, isn't imagination at its core our ability to transcend the here and now and mentally venture into another space and time?

We would never have embarked on the exploration of space without a healthy dose of imagination. Introducing young people to the wonder of space isn't necessarily about giving them a way out of earthly reality. We can at least ensure space serves as an inspiration, not an escape. Tomorrow belongs to the younger generations, and space offers a compelling invitation to build their future, giving them the foundations of curiosity and intellectual rigour, enthusiasm and courage. They will quickly learn that space is demanding and even hostile, that cooperation and concern for your crew is vital and that patience is the key to making new discoveries and dealing with the unexpected.

Maria Anna Mozart said of her younger brother that he had remained an eternal child. Could this be one of the secrets to his genius? To face and build its future, humanity, more than ever, needs such childlike geniuses. So, let us not deprive ourselves of this source of inspiration that is space and our space-related endeavours.

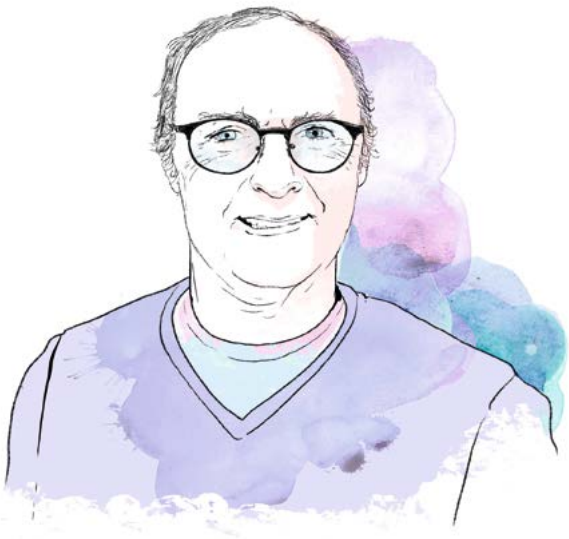
And if this spectacle leaves us speechless, we should not be concerned—after all, wonder is the native language of childhood!

TENUM

"Giving youngsters the desire to do experiments"

Frédéric Bouchar

IT Developer



"Lighting that spark in youngsters' eyes that makes them want to learn more" is what guides everything Frédéric Bouchar does. In 35 years, as a teacher, activity leader and instructor for non-profit association Planète Sciences, he's taught hundreds of kids how to use space data. His story with CNES began in 1999, behind the wheel of the Spatiobus, a roving remote-sensing truck offering education activities and technical training for teachers. The Balloon for a School operation gave classes from primary to high school the chance to design gondolas for stratospheric balloons. "Pupils track their measurements live on screens inside the truck, just like scientists who fly experiments on a satellite," Frédéric explains. Another flagship programme he worked on was Argonautica, studying marine biodiversity, the water cycle, the environment and climate through satellite tracking of wildlife and buoys. He also helped to design Boopy, an educational buoy packed with sensors to explore the oceans. "The data it collected were used to monitor the health of the planet and the consequences of climate change," he explains. Another project devised by CNES is Calisph'Air, geared towards raising awareness about air quality. "It studies the atmosphere and aerosols and particles—sand, smoke and dust—in suspension 3,000 metres above our heads." An experiment to which Tenum, the company he joined in 2007 as an IT developer, is contributing. To determine aerosol concentration and particle sizes in the atmosphere, Tenum has developed the Calitoo photometer. "Pupils conduct local observations, compare their results with other classes around the world and with data acquired by the Calipso satellite and its successors, thanks to the Calinet server developed specially for the project." In 2024, five skippers competing in the Vendée Globe solo round-the-world yacht race took this instrument with them to see if aerosols would be detected at sea. Calitoo is also used by scientists working in Antarctica. "One of them took part in Argonautica when he was younger. It's very rewarding to see that these projects inspire vocations," concludes the former educator. "Through them, I rediscovered my passion for teaching and giving youngsters the desire to do experiments and test things without fear of failure."

CULTURE POUR L'ENFANCE

"I believe in culture as a means of transmission"

Bianca Ciampolini

Projects and Outreach Officer

Our journey begins deep in a tropical rainforest in French Guiana and ends at the edge of the known universe. Destination Cosmos, the ultimate challenge is a 40-minute deep dive into space, conceived by Culturespaces Studio in partnership with CNES. It's a virtual-reality exhibition for children in sterile rooms and intensive care during extended hospital stays. The project is led by Culture pour l'Enfance (Kids' Culture), a grant fund supporting access to culture for children everywhere. "When they don their virtual-reality headset, it's like they've been teleported to the Atelier des Lumières (Editor's note: the venue hosting the exhibition), so it's an amazing sensory experience," notes Projects and Outreach Officer Bianca Ciampolini. In 2024, 94 sick children were immersed in this first-of-a-kind exhibition divided into four chapters to match their daily routine. Each sequence is punctuated by hands-on creative activities like building a rocket or solar system mobile, or painting a galaxy. "CNES supplied us with materials, models, a sky map, photos that we were able to plastify for disinfection, podcasts and so on, to add to our teaching kit for the exhibition," notes Bianca.

These resources are designed for science outreach. Throughout the exhibition, an educator accompanies young patients, answers their questions and adapts to their interests and desires. With its innovative format, Destination Cosmos has also been deployed for home-care patients, for whom culture helps them to feel less isolated, ensures continuity of learning and above all provides "a welcome break from their illness", says Bianca, who remembers a teenager receiving home care for several months. "She was in awe; she told me she wanted to go and live in space and be an astronaut! Culture is vital, it's part of a child's treatment that helps them to hang in there and fight their illness." After a successful launch year in partnership with the APHP university hospital centre in Paris and Bordeaux and Montpellier university hospitals, Culture pour l'Enfance now aims to take the exhibition all over the country. Trials are already underway in Nîmes, Poitiers and Marseille. "I believe in culture as a means of transmission and I'm proud of this project because it's breaking down barriers," concludes Bianca.

CNES

"The multipactor effect is like a storm inside a satellite"

Jules Martinez

PhD student at the Toulouse Space Centre

Ask Jules Martinez where his passion for physics comes from and he'll tell you it's like magic. "I enjoy studying phenomena you can't see like electromagnetism, this weird force that repels things, a bit like the gifts we once attributed to witches or telekinesis," explains the student in the first year of his PhD at CNES. The 26-year-old's research is focused on the multipactor effect, something of a niche subject that he's been working on since his end-of-degree internship at the agency, started in March 2023. To frame it in simpler terms for the lay public, he's found a striking metaphor: "I like to describe the multipactor effect as a storm inside a satellite." This electric discharge phenomenon can cause malfunctions or damage in radiofrequency systems like radar components or satellite antennas. "Waves can no longer get through the clouds of electrons, so signals are disrupted. When these clouds get too large and dense, a flash destroys the component," pursues Jules Martinez. "The multipactor effect can destroy a satellite, because it happens when we try to cram a lot of power into a small space." Anticipating conditions conducive to this multipactor effect is therefore crucial when designing satellites. At CNES for the next three years, the young research scientist is looking at ways of better predicting the phenomenon. "My work consists in enhancing simulation software, understanding what doesn't work and proposing paths for improvement so that it doesn't happen again." The scope of his research combines electromagnetism, materials and quantum mechanics, as he seeks to decipher the mysterious mechanisms at play. He likens his thesis to a police investigation in which he observes each suspect to find out who's guilty and attempt to ascertain their degree of responsibility in the phenomenon. Jules Martinez feels at home at CNES: "I'm working in a field that we're exploring with people who've always supported me and been positive. For me, that's the definition of success in the workplace and an ultimate accolade." After his PhD, Jules can see himself staying in the space sector, guided by his credo: "I want to persist with the multidisciplinary physics side of things to keep exploring phenomena we still don't fully understand."

MINISTRY OF EDUCATION

"We're capitalizing on youngsters' thirst for knowledge to develop science education"

Bertrand Pajot

Inspector General for Education, Sport and Research

"Space is still the stuff of dreams for youngsters, and that's a great thing!" says Bertrand Pajot, Inspector General for Education, Sport and Research. He too has been captivated by space since he was a boy: "Insects, birds, rockets… I've always been fascinated by anything that flies." A penchant that comes from his childhood in French Guiana, fuelled by memories of the first flights of Diamant, the early failures of Europa and the start of the Ariane adventure. And a passion he shared with his peers at his first space summer school at CNES in 1987 as a life and Earth sciences teacher. He soon became an activity leader at this event co-organized every two years by CNES and the Ministry of Education, which brings together 100 teachers eager to learn all about space. "Channelling non-trivial techniques and technologies, like for example radar interferometry, from scientists to students via teachers isn't something you can just improvise," he admits. "But it's really exciting!" He recalls the enriching exchanges with engineers and scientists about ocean altimetry and remote sensing, which proved a precious aid in devising teaching materials for the curricula of primary and secondary schools and higher education institutions. "We're capitalizing on youngsters' thirst for knowledge to develop science education. Space sciences and techniques intersect several scientific disciplines vital to keep track of the key issues facing Earth and humankind." One summer school in particular remains etched in his memory, in Tunis, just after the Oslo Accords in 1993. "There were representatives in attendance from all over the Mediterranean. We were in the field doing reflectance readings while the SPOT-3 satellite was acquiring an image. It was an adventure," he recalls. In June last year, researchers and teachers turned their attention to the SWOT surface water and ocean topography mission. "Everyone was astounded by this tool's power and the teaching applications that could be imagined with it." During his career, Bertrand Pajot has also worked on educational projects devoted to CNES space missions like Andromède, Calipso and InSight. "It's a partnership that sustains space culture and a field of scientific excellence that encourages learning and career paths for students," he concludes.

Growing up and taking off with CNES

A look at just some of the CNES initiatives aimed at future generations.

Opening minds

Today, nine-year-old Gabriel found out why Earth is called the blue planet. Thanks to CNES's L'Espace c'est classe (Space in Class) initiative, some 21,000 primary and secondary students receive a classroom visit from a CNES expert every year, for a first introduction to space.

Ninth-grade work experience

Inaya is 14 and this morning starts her work experience placement at the Guiana Space Centre. She can't wait to visit the facility and learn more about the different careers on offer. Each year, some 150 ninth-grade students complete their week-long work experience at one of CNES's four field centres.

Careers fairs

Paul, 20, is considering the options once he's completed his engineering studies. At this morning's careers fair, he met a CNES employee who set out his own career path, inspiring Paul to join his faculty's student space association.

Grants

Eighteen-year-old Morgane is in the first year of a life and Earth sciences degree at the University of French Guiana, with a view to working to preserve biodiversity. She's one of 25 Guianese students awarded a CNES grant in 2024.

From visits, conferences, holiday workshops and classroom materials to multi-month projects, internships, work-study programmes, PhDs and postdocs, CNES engages with tens of thousands of children, teenagers and young adults every year through a range of initiatives of different types and durations. For some, it's simply an enjoyable experience amid the stars and satellites; for others, it's that initial spark of curiosity set to become a passion; while for yet others, it's a key milestone in acquiring and consolidating knowledge before taking the leap into professional life. From primary schools to first jobs, here's a quick overview of the initiatives that CNES is pursuing, as part of its mission to raise public awareness about space and promote science and technology.

Student projects

Four months after he and his student association friends joined the Perseus project, Paul (now 21) is working on a guidance system that he finds fascinating. His best friend Iman opted instead for the Nanolab Academy, where he's helping to develop a cubesat.

Summer schools

You can even pursue your passion for space during the holidays! Clémence, 20, is at a Universpace summer school to find out more about space careers, while 24-year-old Kim has been selected to attend Alpbach summer school, for work on an exploration mission concept.

PhD and postdoc grants

Next year will see Jayden complete his thesis on the measurement of global CO_2 distribution using data from the MicroCarb satellite. He'll be one of 3,000 young researchers to have received a PhD or postdoc grant from CNES since 1986.

Nurturing talent

Manuella's heart is pounding because tomorrow's a big day... Along with five other former interns, she's been invited by CNES to attend the International Astronautical Congress (IAC), where she'll be able to take part in a series of international discussions and meet space agency VIPs from all over the world.

Earth attractions

Space talk show

CNES has been a partner of the *Science en Questions* (Questions of Science) talk show since 2023. Broadcast on the *Esprit Sorcier* TV channel and YouTube, each 50-minute programme delves into a space-related topic with the help of two guest experts. The latest episode takes viewers on board the Dragonfly mission, which aims to send a rotorcraft the size of a small car onto Titan, Saturn's largest moon. Meanwhile, the Spring 2025 episode promises a deep-dive into scientific investigations led by GEIPAN, the French UAP research and information group.

Space-themed board game

Developed by CNES in partnership with French early-learning company Pirouette Cacahouète, *Mission Espace* (Space Mission) is a space-themed board game. Budding astronauts (from four years up) can throw the dice and climb the space spiral to complete their mission. A fun way to learn about space, but watch out for the traps!
€22.90 – Available on maboutique.cnes.fr

Tell me about space… in book form!

What are satellites for? Do rockets pollute space? In each episode of *Raconte-moi l'Espace* (Tell Me About Space), the CNES podcast launched in 2022, an expert answers children's questions about space. Both seasons are available on the CNES podcast platform, Spotify, Deezer, the Apple podcast, Radio France and Merlin audio-speaker. And now there's a book, featuring 40 questions illustrated by Naomi Kado, with abridged answers and a QR code to the relevant podcast to find out more. Published in partnership with Privat.
Raconte-moi l'espace, with sticker sheet: €17.90€ - Available on maboutique.cnes.fr

Dedicated student section on cnes.fr

Are you looking for a job or internship? Are you a PhD or postdoc student with a project proposal for CNES? Go to the new, dedicated section on cnes.fr to access CNES job offers, training courses and projects.
cnes.fr/For students (in French)

Space mobile game

To raise awareness of space debris issues, CNES has partnered with World Game to develop Orbital Dance, a game you can play on your mobile! Your mission? To steer a satellite in orbit around the Earth without colliding into space debris.
Free to download from Apple Store or Google Play.

Two great new adventures

CNES is raising young people's awareness about space and climate challenges through illustrated books. Published by Privat, *SOS au Pôle Nord* (S.O.S at the North Pole) follows the Argonautica project as its scientist, Andromède, tries to locate a young polar bear on the Arctic sea ice that is melting fast due to global warming. Meanwhile, in *Tim et le Robot* (Tim and the Robot), a little boy joins Cury the robot on his spaceship for a treasure hunt around the solar system. Two must-read publications!
SOS au Pôle Nord, with sticker sheet: €10.90 – Available on maboutique.cnes.fr

Sporting CNES colours

This "made in CNES" T-shirt is available in children's sizes, ages 6 to 12. Navy blue and made of organic cotton, it will make you a true French space ambassador! *€16.90 – Available on maboutique.cnes.fr*

DIARY

15-17 MAY 2025:
CNES'S FESTIVAL ÉDUCATION JEUNESSE (Youth Education Festival), at the Toulouse Space Festival. A chance to discover the different careers available and meet space pros. Young visitors will be able to learn the basics of block coding, build a 3D moonbase and take part in an astro sports challenge.

5-12 JULY 2025:
62ND EDITION OF C'SPACE, the student space-project summer camp.

C'Space: hands-on space

Co-organized every summer since 2009 at the Camp de Ger military base in southwest France by CNES, non-profit association Planète Sciences and the French Army, C'Space brings together youngsters from all over the world to work on science and engineering projects from conception through to launch. Mini-rockets, experimental rockets, CanSats or balloons: the choice is theirs!

MINI-ROCKETS

Youngsters can build their own mini-rocket from the age of 13 at school or in a club, provided they master flight stability concepts. The main aim is to build a system capable of deploying a parachute automatically at precisely the right moment, by calculating its flight trajectory.

From junior high upwards

EXPERIMENTAL ROCKETS

High-school and undergraduate students get the chance to fly a science experiment on a rocket of their own design. This calls on a broad range of skills to ensure mission success.

From high school upwards

CANSAT

CanSat gives students hands-on experience of a space project as they build a satellite no larger than a Coke can, release it from a drone and then collect data acquired in flight.

Undergraduate students

EXPERIMENTAL BALLOONS

Discovering space technologies and studying the atmosphere up to an altitude of 30 kilometres using balloons is an original way of learning and building team spirit. A unique experience awaits, from design of the balloon's gondola to launch.

From 10 to 25, at school or in a club