

THE SPIRIT OF SPACE











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FOR 2021-2025, WE'LL NEED TO BE EVEN MORE IMAGINATIVE TO PREPARE FOR THE FUTURE!

with Jean-Yves Le Gall CNES President

The Space19+ ESA Ministerial Conference proved a huge success for Europe's space programme, securing a budget of nearly €14.4 billion. What are the main lines of action to come out of it?

This conference, co-chaired by Frédérique Vidal, our Minister for Higher Education, Research and Innovation, was a great success in several sectors that France advocated for. First, for Europe's independent space launch capability; second, in two other areas where CNES has been a precursor in recent years, namely climate and Earth observation through the Copernicus programme and exploration of the Moon and Mars; and third, industrial competitiveness, particularly in the telecommunications sector, which received significant funding aided by CNES's contribution to ESA and through our national programme. The final result is that we've approved a historic budget that stands to greatly benefit Europe and its industry.

Europe is now poised to step up a gear in a fast-changing space landscape. What role does CNES have to play in this new phase, in particular in the light of its next Objectives and Performance Contract for 2021-2025?

CNES has been leading the way in recent years as the first to make innovation, climate actions and international cooperation its priorities. We're seeing the benefits of this strategy for the national space policy and industry. We're now laying the groundwork for our next Objectives and Performance Contract and the agency will continue to move forward. Space is undergoing a deep transformation that isn't set to end anytime soon. That means we need to be even more imaginative in planning for the future and fuelling uptake of the many applications of space by helping and training users to better understand and appropriate it for themselves.





Coming off the back of the celebrations to mark Ariane's 40th anniversary and its 250th launch, what conclusions do you draw from these last four decades and how do you see the future? What role is the Guiana Space Centre set to play in supporting France and Europe's launcher ambitions?

We're all Ariane's children! Forty years ago, Europe had no space programme and no space industry to speak of. Thanks to our launcher, we've built an industrial base that's the envy of the world and the space sector is now developing all over the globe. What strikes me most is that we're seeing more and more players not only in applications and satellites, but also in launchers, and in this context the Guiana Space Centre—which is more than ever Europe's spaceport—will continue to play a pivotal role. We'll be kicking off a major refurbishment programme at the base in 2020, with the funding that France succeeded in securing at Space19+.

What are the main modernization projects CNES is undertaking to remain a leading player in the international space arena?

For several years now, CNES has clearly shown its ability to work with partners. We're working closely with the world's leading space powers—China, the United States, India, Japan and Russia—for whom we are often their number one partner. We've also signed numerous agreements with new entrants to the international space arena to support their development and encourage them to 'think France' for the benefit of our industry. All of this would be impossible without the hard work we do to further our international relations, and most of all without our renowned science and engineering excellence, which we must maintain in the face of increasing competition. Today, France is working with everyone across the board.

Space exploration has regained momentum in recent years. While Mars remains a prime destination, the Moon is also back in the game. What is CNES's perspective on these major scientific challenges?

France is fortunate to have one of the world's most eminent space science communities, and its efforts are being extended by CNES's engineers, as we saw at our latest Science Survey Seminar in Le Havre last October. We also have a rich technological heritage in human spaceflight with the CADMOS centre in Toulouse, which is the lead European centre for human physiology. This allows us to pursue our niche strategy of flying on our partners' large-scale missions. As a result, we're central to the most ambitious projects being developed by all of the major space powers and we'll of course be a part of the new robotic and crewed lunar adventures ahead.

The environment is a priority for the government. What role does CNES have to play in tackling climate change?

CNES was the first to get behind efforts to tackle climate change in 2015 in the leadup to the COP21 conference. We decided on two satellites now in development at our agency to measure the two main greenhouse gases: carbon with MicroCarb and methane with MERLIN. And in 2017, at the request of President Macron, we put forward the idea of a Space Climate Observatory (SCO). The founding document of this new initiative was signed on 17 June last year at the Paris Air Show and we're going to continue developing it. The SCO is a great tool supporting our diplomatic efforts and for extending our influence and developing our industry. We've signed up 30 international partners and charted a clear course, leveraging space systems to make the SCO the world benchmark in the field of climate action.

Dynamic start-ups, innovative SMEs and big space manufacturers are driving development of new space applications. How does CNES intend to support and encourage this trend?

CNES has developed numerous tools to nurture and cultivate a new space ecosystem. *Connect by CNES* puts all of these tools at the disposal of start-ups and SMEs looking to develop their space business. We're going to continue pursuing targeted actions, working notably in close partnership with regional councils to aid economic development. These contacts are spawning a lot of ideas for services using satellite data. We're assisting entrepreneurs with technical, legal and financial aspects to help them turn their ideas into viable businesses. CNES will continue to lead all of these efforts in pro-active fashion.

France's military space strategy is in the midst of a major transformation. How does CNES intend to apply this strategy to fulfil the Ministry of Armed Forces' new objectives?

The new impetus for our military space strategy was announced on 13 July by President Macron at the Hôtel de Brienne in Paris and subsequently confirmed and developed by the Minister for Armed Forces Florence Parly. Ever since its inception, CNES has cultivated the dual-use nature of space, which today is one of its great strengths and something that's rarely seen in other countries. We're therefore quite naturally playing a key role in applying the new military space strategy and will be hosting the new Space Command at our Toulouse Space Centre. CNES is fully focused on serving the nation's defence policy and is working actively with the Ministry of Armed Forces to invent and plan future military space systems, to oversee their development and to operate them. So we're pursuing and amplifying our dual-use activities for the benefit of both civil and military space.

"We've approved a historic budget for Europe and our industry."

A POLITICAL AMBITION

"As a government agency, CNES has an active role to play driving France's economic and social development."

CNES has been an innovator ever since its inception in 1961 and this continuing commitment is the foundation of the agency's Objectives and Performance Contract (OPC) with the government, renewed every five years. The OPC covering 2016-2020, entitled 'Innovation & Inspiration', has fulfilled its objectives. The new contract will chart the course for our partnership with industry and institutions for the next five years. Our mission is to accomplish a political ambition we have been pursuing for close on 60 years, with the clear goal of building a future in which space serves us all.





DIPLOMACY IS THE KEY

International relations are all about diplomacy, and space is no exception. Our representatives in Brussels, Berlin, Washington D.C., Moscow, Tokyo, Bangalore, Abu Dhabi and Beijing are constantly seeking to consolidate cooperation with the agency's longstanding partners. Working every day in close contact with their local contacts, they assist France's ambassadors in all matters pertaining to space.



MEETING OF SPACE AMENING VICTOR

ANGELSSATELITS

Every five years, the government renews its pact with CNES and sets us specific objectives to forge new industry partnerships, develop innovative solutions to current and future needs, and tackle climate change to name a few. Under our Innovation & Inspiration OPC, we have embarked on a deep transformation and accomplished the missions we have been assigned, branching out into artificial intelligence, biotechnologies and new energies, setting in train our Connect by CNES initiative and embracing the digital revolution. Between 2016 and 2020, we have invented the future of space. The next OPC, covering the 2021-2025 period, will outline the government's new space policy ambitions. We have already started laying the first foundations of this plan through the Strategy 2025 process to which all of CNES's employees are contributing. The new contract will be signed during the course of 2020.

BUDGET INCREASE

France is one of the main sources of funding for ESA through its very substantial contribution of €1.401 billion to the agency's budget in 2020, up almost 20% on the previous year. We are also committed to supporting the European Union's space programme, in particular its flagship Galileo and Copernicus programmes.

FOUR CENTRES OF EXCELLENCE

"The agency's core strategy is geared towards extending its sphere of influence and actions through scientific, industrial and international partnerships."

To execute the nation's space policy, we rely on strong shared values like excellence, enthusiasm and the desire to rise to the challenges that lie ahead. Our 2,363 men and women are working hard to lay plans for the future, make French industry more competitive and sustain scientific and operational excellence. Engineers and executives—37% of them women—account for 82% of our personnel. With our four centres of excellence in Paris, Toulouse and Kourou, we are helping to extend the influence of French space policy.



Our experts in Paris Les Halles have two key missions: to map out French and European space policy and to craft and coordinate CNES's national, European and international programmes. Every year, CNES signs tens of multilateral agreements, laying the foundation for new science and technology partnerships. The agency also works of course with a broad spectrum of academic, scientific, industrial and business partners in France.

HEAD OFFICE

2, PLACE MAURICE QUENTIN, 75039 PARIS CEDEX 01, TEL : +33 (0)1 44 76 75 00 Paris Daumesnil is home to DLA, which is instrumental in operating Europe's Ariane 5 and Vega launchers and Soyuz in French Guiana. Ariane 6 poses a new challenge for CNES, which is prime contractor for all of the launch facilities in French Guiana, its chief objective being to bring down operating costs. Drawing on the 40-year heritage of the Ariane programme, DLA's experts are working to invent the launchers of tomorrow.

LAUNCH VEHICLES DIRECTORATE 52, RUE JACQUES HILLAIRET, 75612 PARIS CEDEX, TEL : +33 (0)1 80 97 71 11

LAUNCH VEHICLES DIRECTORATE (DLA): LAUNCH SYSTEMS

Our engineers in Toulouse conceive, design, develop, build, position, control and operate orbital systems. Their work also involves fostering uptake of satellite data for the benefit of all and innovating and creating to imagine tomorrow's space systems. To this end, our teams are tasked with supporting all potential space user communities and encouraging uptake of space applications where they are most needed in our daily lives. With 800 employees from external contractors also on site, the CST is CNES's largest technical and operational field centre. In the years ahead, it is set to undergo a major transformation, notably as the site of the future Space Command.

> TOULOUSE SPACE CENTRE 18 AVENUE EDOUARD BELIN, 31401 TOULOUSE CEDEX 9, TEL : +33 (0)5 61 27 31 31

TOULOUSE SPACE CENTRE (CST): ORBITAL SYSTEMS AND OPERATIONS

The CSG in French Guiana guarantees Europe's independent space launch capability. The 1,700 people working for 40 European firms at the base are charged with launch preparations. At the launch base, CNES coordinates and leads launch operations, prepares satellites and is responsible for range safety and ensuring compliance with environmental regulations. With its modern facilities, three operational vehicles and regular launches, the CSG is gearing up for the future and a key plank of Europe's space strategy.

GUIANA SPACE CENTRE BP 726, 97387 KOUROU CEDEX, TEL : + 594 (0)5 94 33 51 11

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GUIANA SPACE CENTRE (CSG): LAUNCH OPERATIONS 2020 BUDGET



WHO FUNDS CNES?

To accomplish our missions for space activities on behalf of the government, CNES receives funding from the budget lines provided for in our Objectives and Performance Contract (OPC), from the PIA future investment programme and from external sources for programmes where we have delegated responsibility (DGA, ESA, Eumetsat, etc.). • ESA CONTRIBUTION:



• NATIONAL PROGRAMME:

€705m

• OWN RESOURCES:



PIA FUTURE INVESTMENT PROGRAMME:

€49m

Inche

AN EXCEPTIONAL BUDGET

"Efficiency is our watchword: we very often do more and better with the same budget than most other space powers."

Every year, CNES's budget is voted by parliament and our accounts are signed off by our auditors. In line with the agency's objectives, our income and expenditure are examined by independent bodies mandated to ensure they are used as intended, notably for the benefit of France's industry and scientific community. For 2020, we have been granted an exceptional increase in our budget of 140/o, taking it to €2.780 billion.

FRANCE

"Space-related disciplines need more engineers, research scientists and entrepreneurs inspired by space."

CNES plays a pivotal role in the national space industry, which sustains a total of some 20,000 jobs. As a space pioneer, we are constantly seeking solutions to meet new challenges, drawing on the expertise of our field centres to conceive, develop and operate launchers and space systems. We are also working closely with many French research laboratories and manufacturers, and supporting government in strategic civil and military domains.



MAKING 'THINK FRANCE' A REFLEX RESPONSE

CNES is encouraging its international partners to '**think France**' and turn to French space manufacturers to boost their competitiveness.



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SME PACT

Since 2018, we have been pursuing our pact with small and medium-sized firms (SMEs). This plan ties in with CNES's strategy of supporting industrial development to meet the needs of institutions and society. Covering 30 actions to promote SMEs, it is focused on four main areas:

- Spinning off innovations from SMEs into the field of space
- ► Making it easier for SMEs to work as government suppliers
- ► Forging closer ties between SMEs and CNES
- Helping SMEs to develop other business outside contracts with CNES

ANGELS NANOSATELLITE AT NEXEYA

EUROPE

"More than ever before, we are assuming our role as the backbone of Europe's space programme."

Since 1975, the European Space Agency (ESA) has been conducting European space policy for its member states—currently numbering 22—and on behalf of the European Union through the Copernicus and Galileo programmes. Its leading contributors are France and Germany. Working with our partners, we are guaranteeing Europe's independent space launch capability and making a big impact on the international stage as we help to ready new generations of space systems for European citizens.

REAFFIRMING A SHARED COMMITMENT

Europe is the world's number two space power, a position it owes to its member states and national agencies, ESA and the European Union. Over the years, they have succeeded in translating their close cooperation into political action.

The regulation setting out the European Union's space programme was negotiated in 2019 and the envisioned budget of €16 billion over seven years remains to be confirmed during discussions in 2020 on EU budgets for the 2021-2027 period.

ASSURING ACCESS TO SPACE

The budget envelope of $\notin 2.238$ billion recently voted in Seville to sustain access to space must serve to make Ariane 6 and Vega C more competitive, develop the technology building blocks of the future with the Prometheus engine and fund the refurbishment of the Guiana Space Centre (CSG).



STEPPING UP A GEAR



The Space19+ ESA Ministerial Conference on 27 and 28 November 2019 in Seville proved a great success for Europe's space programme, with nearly \in 14.4 billion in funding secured for 2020-2022 (2020-2024 for the agency's mandatory programmes).

Among the key decisions taken at the conference, ESA confirmed its commitment to assuring independent access to space with €2.238 billion allocated to launcher programmes, and to sustaining Europe's strong role in future human and robotic exploration programmes (€1.953 billion) and its leadership role in Earth observation, notably in support of climate actions (€2.541 billion); and increased its science budget (to €2.823 billion) while boosting its effort to sustain industrial competitiveness with €1.511 billion allocated to the ARTES satellite telecommunications programme.

These impressive budgetary and programmatic figures confirm a number of structural trends underlying Europe's space effort. First, as a tool supporting a broad spectrum of public policies in the fields of climate, the environment, security, transport, agriculture, the digital divide and research, the space sector is now receiving constant political support and the funding to match it from Europe's policymakers.

Second, Europe has never been stronger than when it gets national ambitions working for the overall good. Taken together, the scientific, programmatic and industrial priorities of its member states thus form a coherent and wide-ranging European space programme.

And third, Space19+ was a success because spacefaring Europe adopted a global rather than an inward-looking perspective, strengthening its credibility as a go-to international partner for all large-scale space missions in science, exploration and Earth observation. Likewise, it is banking on innovation and competitiveness, notably in telecommunications, launchers and Earth observation, to stay ahead.

RESALIND FRANKLIN ROVER



ON THE WORLD STAGE

"CNES has become a linchpin of the international diplomatic apparatus."

Irrespective of competition and NewSpace, international cooperation remains a fact of life in the space sector and many partnerships have given rise to complex scientific projects and humanitarian or climate initiatives. CNES is securing agreements around the world, building technology bridges between nations without losing sight of our mission to promote French industry.



A GO-TO PARTNER

Today, CNES has three types of international partnerships:

- European partnerships, through the European Space Agency (ESA) or the European Union (EU), thanks to which we remain a pivotal player as the leading contributor to ESA and the main inspiration behind the EU space strategy and regulation.
- Historic, foundational partnerships with the world's leading space players outside Europe—China, India, Japan, Russia and the United States—that form a key part of CNES's international efforts.
- And partnerships with new space powers—Israel, Mexico, Morocco, Singapore, South Korea, the United Arab Emirates and Vietnam—whose ambition is to transform their societies and economies through space.





LAUNCHERS

"Ariane is among Europe's finest technological, industrial and commercial achievements. After marking its 40th anniversary in 2019, it must now continue the adventure to keep pace with strong global competition."

Ariane has given Europe its own independent space launch capability, proving its excellence and reliability time and time again. As Ariane 6 prepares to take over the mantle, we are gearing up for the future with our partners to maintain our edge in a fiercely competitive market where new entrants are making their presence felt. This means developing new technologies and new ways of working to rise to the challenge and get the next generation of launchers to the pad.

GUIANA SPACE CENTRE

Spanning 700 sq.km and with three operational launch complexes, the Guiana Space Centre (CSG) is poised to bring the ELA-4 launch pad into service for Ariane 6. The future of the launch base is also assured through the **CSG New Generation** programme that got the go-ahead in Seville. These investments will serve to give the infrastructures and networks a new lease of life, while meeting the base's Sustainable Development Goals (SDGs) and modernizing its facilities and operational processes.

As Europe's gateway to space, the CSG is gearing up to support the leap in competitiveness Ariane 6 and Vega C must make to face growing global competition. The base's attractiveness and the degree of excellence its customers from around the world expect will thus be maintained with the highest level of quality, reliability and availability. Construction of the new Operations Centre (CDO) is set to start in 2020 to house all launch support facilities under a single infrastructure.



Construction of the ELA-4 complex that will launch Ariane 6 is nearing completion in French Guiana. We have undertaken this colossal effort to give birth to an exceptional infrastructure consolidating the CSG's position as Europe's spaceport. Everything is being readied for the maiden flight of the new launcher, whose mission will be to meet market demand and significantly bring down the cost of getting into space.



CALLISTO, THEMIS AND PROMETHEUS

The goal of the **Callisto** project is to test a recoverable launcher first stage. The technologies and know-how engaged for this reduced-scale demonstrator will be one of the key components of the **THEMIS** programme prefiguring the launchers of the future. We are working on Callisto in partnership with the German space agency DLR and the Japanese space agency JAXA.

The new-generation **Prometheus** engine will power the THEMIS demonstrator. Based on an idea from CNES, it is being developed by ArianeGroup for ESA and represents a major technological leap. Prometheus will be reusable up to five times and ten times cheaper than the current generation of engines, making it a key competitive asset for future launchers. The first model is expected to be finalized this year.



CNES and ArianeGroup are joining forces and combining their expertise to build the future generations of European launchers. To this end, we have set up ArianeWorks together, an acceleration and prototyping platform operating like a start-up and dedicated to launch vehicle innovation. ArianeWorks is working notably on the THEMIS low-cost reusable launcher demonstrator based on the very latest technologies heralding future evolutions of Ariane.

The project is focusing in particular on experimentation, speed, environmental performance and short decision cycles. Several other industry players have joined the founding members in recent months, including the French aerospace lab ONERA and Swiss firm APCO.





"CNES is constantly consolidating its ability to innovate while leading a range of initiatives to spur and sustain the space ecosystem."

Satellites have become a ubiquitous feature of our lives, be it for the environment, mobility, defence, communication or the advance of science. CNES possesses unique science and engineering expertise to develop new missions, alone or with international partners, and we are federating the national research community and industry to get them working on the space programmes of the future.

UPPER ATMOSPHERE

Taranis, the first space mission conceived to observe the transient luminous events (TLEs) that occur above large storm clouds when lightning strikes, is eagerly awaited by the scientific community. The microsatellite conceived by CNES has 15 cutting-edge instruments to analyse these events, including an ultra-fast detector that will be used for the first time in space. The payload will be mounted on a spacecraft bus from CNES's Myriade line, developed to accomplish space missions quickly and cheaply. Taranis is scheduled to launch in 2020 atop a Vega vehicle.

SCIENCE

PHARAO will be the first cold-atom clock ever to orbit Earth, attached to a porch on the European Columbus module outside the International Space Station (ISS). We were the prime contractor responsible for integrating the instrument, in partnership with French research laboratories. PHARAO is the core component of the European Space Agency's ACES mission (Atomic Clock Ensemble in Space). It will be ferried to the station in 2021 by a U.S. Dragon spacecraft.



DEEENCE

CNES plays a key role implementing the military space strategy designed to assure France's security and independence. Three latest-generation programmes developed for the Ministry of Armed Forces are consolidating our nation's position as one of the world leaders in this domain. Two new military satellites will be launched in 2020:

- ► CSO-2, a very-high-resolution reconnaissance satellite
- Syracuse IV A, a latest-generation secure telecommunications satellite

APPLICATIONS

"We are a key catalyst creating gateways between the space and non-space communities."

The vocation of space assets is to enable real-world solutions and services on Earth that improve our daily lives, enhance public services and boost business performance. Conceiving useful applications requires mature technologies, a solid understanding of their potential uses and the ability to get project promoters from often very different horizons to work together effectively. This is the role of CNES, whose expertise is helping to bring the benefits of space to the widest number.



GALILEO

In 2020, two new Galileo satellites are set to be launched from the Guiana Space Centre. The navigation system is expected to reach full operational capability in 2021 with the launch of the last six satellites in the constellation. Galileo has already garnered more than one billion users and delivers unrivalled positional precision of one metre, making it the best system of its kind in the world—a system to which CNES is a major contributor.

COSMICAPITAL



In the space sector, technological innovation is obviously paramount, but economic innovation is equally important. It is with this aim in mind that we created the CosmiCapital investment fund to provide financing for European start-ups in all areas of space and its applications. In 2020, we will continue to work with private and public investors and industry to help new space players and bring the most innovative projects to fruition.

CONNECT BY CNES

Besides historic space programmes in the domains of science and defence, where CNES is traditionally a prime player, space can also be a key driver of economic, social and environmental development for businesses. New applications are now being opened up by space technologies and solutions in association with big data and artificial intelligence.

In this context, we created our *Connect by CNES* programme to support and federate the space user community in Europe and around the world.

Connect by CNES chiefly covers sectors that are going to prove crucial to our future, such as the environment, healthcare and mobility, working with partners from all horizons—from start-ups to large industrial groups and public institutions. To help them complete their projects, we advise them and give them access to our top experts and tools.

We also assist them with incubation, booster, training and funding processes. Our strong network of partners covers all of France and we are present in every region in key locations like Station F in Paris or Start-Up City in Toulouse.

Our goal in 2020, more than ever before, is to fuel technology spin-off and spawn future business champions.



"Ever since its inception, CNES has continued to innovate and this ability is a key asset in today's world."

Shaped by the digital revolution, disruptive technologies and NewSpace, the world today is in a constant state of flux as the space sector undergoes deep transformations driven by the daily challenge of innovation. A challenge we are meeting by mobilizing French start-ups, large manufacturers and research centres within a 'space team' to boost our competitiveness and invent solutions scaled to the needs of space technology users.

ULTRA-FAST BROADBAND INTERNET

With **THD-Sat**, we are supporting innovation to bring ultra-fast broadband Internet connectivity to all. Over the last 10 years, our R&D programme has seeded new technologies able to deliver Internet service just as well as optical fibre and with a tenfold increase in power over previous-generation satellites. Ready to enter service in 2020, these innovations will feature on the future **Konnect VHTS** satellite. By providing ultra-fast broadband connections to 300,000 homes in rural and remote areas, they will eliminate the last remaining 'not-spots' in France and help directly to bridge the digital divide.

ALL-ELECTRIC SATELLITES

January 2020 will see the first all-electric satellite from the **Neosat** programme (**Spacebus NEO**) launched by CNES and ESA to support the competitiveness of European industry. The first in the **Konnect** series of satellites is designed to deliver broadband Internet services to Africa and Western Europe. It will be followed in 2021 by **Hot Bird Next** (on a **Eurostar NEO** bus).

Electric propulsion is driving a revolution in the space industry, significantly reducing telecommunications satellite mass and cost. We are working very closely with European manufacturers to develop this new generation of spacecraft.



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TELECOMMUNICATIONS

Another R&D programme conceived to boost our industry's competitiveness and reaching maturity this year is **GEICO**. Working with stakeholders in this sector, we are developing innovations that will enable true technological and commercial break-throughs in telecommunications and television broadcasting. The first products will be ready for launch this year.



"Earth is under the constant watch of satellites taking its pulse and allowing us to anticipate its likely evolution."

The International Charter on Space and Major Disasters, founded by CNES with ESA and the Canadian Space Agency (CSA), has been activated more than 630 times in nearly 20 years, showing that extreme weather events are growing more intense. Tackling climate change is a priority for France and we are mobilizing international efforts in this direction through the newly created Space Climate Observatory (SCO). Our broader objective is to provide scientists and citizens with precise data and impact studies and to embrace a sustainable development approach.



The Space Climate Observatory (SCO) was officially brought into being by President Emmanuel Macron in June 2019 at the Paris Air Show. A declaration of interest was subsequently signed by 25 space agencies and international organizations.

2020 will be devoted to putting together a global network and kicking off the first pilot projects. Meetings will be convened at scheduled international gatherings to regularly review their progress.

In France, the SCO offers a real opportunity to federate research efforts in different disciplines and chart a common course leveraging shared resources and expertise from major national operators and institutes like Meteo France, IGN, Ifremer, CNRS, IRD, INRA, AFD and BRGM.



DEDICATED MISSIONS

Orbital systems are the most effective tools for observing climate change and checking that commitments are being kept. To this end, space agencies are continuing to innovate to acquire vital new measurements required to meet the goals of the Paris Agreement. As a pioneer in Earth observation, we are bringing to the SCO our archive of more than 30 years of satellite data from the SPOT and Jason series, IASI, Megha-Tropiques and now CFOSat. These data will help to gauge new climate variables and will be complemented by the **MERLIN** and **MicroCarb** methane and carbon dioxide monitoring missions.

SUSTAINABLE DEVELOPMENT GOALS

In 2015, the 193 member states of the United Nations adopted the Agenda 2030 sustainable development programme, which sets out 17 Sustainable Development Goals (SDGs) to tackle poverty and inequality and move towards a sustainable development model.

In France, the Agenda 2030 roadmap defines priority challenges with respect to climate actions to preserve the planet and its biodiversity.

CNES is contributing to the SDGs through its space missions and management system. We are applying sustainable development practices through our corporate policies (environment, procurement, human resources and workplace health and safety) and actions (preservation of biodiversity, eco-design, energy savings, waste reduction, sustainable mobility solutions). Our ODDE sustainable development goals project decided in 2019 will chart the course ahead for the agency in this respect.

SCIENTIFIC BALLOONING

As a prime operator of high-altitude balloons crucial to studying the atmosphere and climate, we are leading the European HEMERA 1&2 initiative that aims to make it easier for Europe's scientists to take advantage of these research platforms and launch facilities. Twenty experiments have been selected to fly in 2020. Meanwhile, the **Magic 3** survey campaign is paving the way for future space-based missions to track greenhouse gases like MERLIN and MicroCarb, while **Fireball** is a French-U.S. experiment designed to detect the faint and diffuse emission of the intergalactic medium also set to fly this year. Lastly, the **Strateole-2** campaign to study climate perturbations and weather forecasting is continuing into April. The results will be analysed in real time by a panel of French and U.S. research laboratories.



"Space is undoubtedly inspiring the future of humankind."

In its quest to unravel the mysteries of the universe and better understand who we are and where we come from, space exploration is pursuing a twofold scientific and strategic goal. It is undoubtedly the domain where international cooperation is the most mature, fuelling new discoveries and forever pushing back the boundaries of knowledge. CNES is contributing to numerous European programmes and working with all space nations in this field, bringing our partners renowned technological expertise that draws on a heritage of more than half a century in robotic and human spaceflight.

MAR52020ROVER

MARS 2020

In the summer of 2020, a new NASA mission will depart from Cape Canaveral, Florida, on a seven-month journey to the red planet to bring back samples from its surface. The **SuperCam** payload on the Mars 2020 rover consists of a camera, a laser and three spectrometers. The first of these is intended to probe the chemical composition of rocks and soils, while the second will perform mineral analysis complemented by the third, which will detect any organic molecules that might be present. A microphone will also listen for surrounding noise. This cutting-edge instrument is an international effort led by CNES, illustrating France's prowess in space exploration.

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EXOMARS

Are there traces of life on Mars? To attempt to answer this question scientifically, ESA and Russia are set to launch a roving laboratory this summer called Rosalind Franklin, after the British physicist and chemist who pioneered molecular biology. The ExoMars orbiter will acquire measurements for a whole Martian year—687 Earth days—to study the planet's environment and biological conditions. In so doing, it will no doubt also tell us a great deal about how Earth formed.

HUMAN SPACE-FLIGHT

In 2017, astronaut Thomas Pesquet spent six months on the International Space Station (ISS). He has now been assigned by ESA to a second mission in 2021, which will make him the French record holder for the most time in space. Besides its symbolic aura, the ISS is a unique orbital science outpost and a fine example of successful international cooperation between the United States, Europe, Russia, Canada and Japan, in which France, through CNES, is playing a key role. ESA confirmed in Seville a budget of €2 billion for space exploration, including spaceflights for two Europeans and funding for the ISS through to its retirement from service.

SOLAR ORBITER

The European Solar Orbiter probe is set to embark on its deep-space expedition in February 2020, approaching to within 40 million kilometres of the Sun to observe it as never before. It will deliver new insights into the solar wind and its direct impacts on Earth in the shape of aurorae borealis and sometimes major magnetic disturbances. For this ESA mission, we are supplying the Radio and Plasma Waves instrument (RPW) that will analyse electrons from the Sun–a world first–and working on five of the 10 other scientific instruments on the payload.





2021

THE DATE FRENCH ASTRONAUT THOMAS PESQUET WILL MAKE HIS SECOND FLIGHT TO THE INTERNATIONAL SPACE STATION TO PERFORM A NEW SERIES OF EXPERIMENTS FOR CNES AND ESA.

DATE À LAQUELLE L'ASTRONAUTE FRANÇAIS THOMAS PESQUET S'ENVOLERA DE NOUVEAU VERS LA STATION SPATIÀLE INTERNATIONALE POUR MENER DE NOUVELLES EXPÉRIENCES - POUR LE CNES ET L'ESA.



ELECTRIC-PROPULSION SATELLITES CURRENTLY IN PRODUCTION OR DEVELOPMENT, WITH FUNDING FROM FRANCE THROUGH CNES.

SATELLITES À PROPULSION ÉLECTRIQUE SONT EN COURS DE FABRICATION OU EN DÉVELOPPEMENT, AVEC LE SOUTIEN FINANCIER DE LA FRANCE, À TRAVERS LE CNES.



1,400 MILLION

IS WHERE THE U.S.-EUROPEAN JAMES WEBB SPACE TELESCOPE (JWST), THE SUCCESSOR TO HUBBLE, WILL ORBIT. IT HAS TAKEN 20 YEARS TO BUILD AND WILL BE LAUNCHED BY A SPECIAL VARIANT OF ARIANE 5.

DE KM DE LA TERRE,

C'EST L'ORBITE EN 2021 DU PROCHAIN TÉLESCOPE AMÉRICANO-EUROPÉEN, JAMES WEBB, SUCCESSEUR DE HUBBLE. SA CONSTRUCTION A NÉCESSITÉ 20 ANS ET SON LANCEMENT SERA RÉALISÉ PAR UNE ARIANE 5 SPÉCIALE.





ACTIVATIONS OF THE INTERNATIONAL CHARTER

ON SPACE AND MAJOR DISASTERS REQUESTED FROM AROUND THE WORLD SINCE NOVEMBER 2000 TO COME TO THE AID OF VICTIMS OF NATURAL DISASTERS SUCH AS FLOODS, CYCLONES, WILDFIRES AND LANDSLIDES.

ACTIVATIONS DE LA CHARTE INTERNATIONALE ESPACE ET CATASTROPHES MAJEURES ONT EU LIEU DANS LE MONDE DEPUIS NOVEMBRE 2000, EN AIDE AUX VICTIMES DE DÉSASTRES NATURELS (INONDATIONS, CYCLONES, INCENDIES, GLISSEMENTS DE TERRAIN...).



COMMITTED TO CURBING THEIR GREENHOUSE GAS EMISSIONS UNDER THE PARIS AGREEMENT.SIGNED IN-2015, INCLUDING IN HOW, THEY BUILD THEIR SATELLITES.

NATIONS SE SONT ENGAGÉES À LIMITER LEURS ÉMISSIONS DE GAZ À ÉFFET DE SERRE DANS LE CADRE DE L'ACCORD DE PARIS SIGNÉ EN 2015 Y COMPRIS DANS LÀ RÉALISATION DE LEURS SATELLITES.





SIRISPACE

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