This paper is NOT an official publication from the French Armed Forces. It provides an update on the French military operations and main activities. The French Defense Attaché Office has drafted it in accordance with open publications.

The French Armed Forces are heavily deployed both at home and overseas. On the security front, the terrorist threat is still assessed as high in France and operation “Sentinelle” (Guardian) is still going on. Overseas, the combat units are extremely active against a determined enemy and the French soldiers are constantly adapting their courses of action and their layout plans to the threat.

Impacted by the Covid-19 pandemic, the French Armed Forces have resumed their day-to-day activities and operations under the sign of transformation and modernization.

IN MEMORIAM

On September 5th, during a control operation within the Tessalit region, three hussards were seriously injured after the explosion of an Improvised Explosive Device. Despite the provision of immediate care and their quick transportation to the hospital, the hussard parachutiste de 1ère classe Arnaud Volpe and brigadier-chef S.T died from their injuries.

On November 12th, during a routine mission in the vicinity of Sharm el-Sheikh, Egypt, nine members of the Multinational Force and Observers (MFO) were involved in a helicopter crash. The crash cost the life of lieutenant-colonel Sebastien Botta, as well as those of five US service members and a Czech service member.

1 According to the request of the family, his name was not communicated;
1. OPERATIONS

1.1. DEPLOYMENT OF THE FRENCH ARMED FORCES

1.2. THEATERS NEWS

CHAMMAL: MULTINATIONAL JOINT OPERATIONS IN SYRIA AND IRAK

Launched in September 2014, on request of the Iraqi government and in coordination with allied forces, operation Chammal is providing air and ground support as well as training to Iraqi forces committed against ISIS and other terrorist groups. The operation has been extended to Syria following the terrorist attacks in November 2015.

France's contribution to the operations in these areas is mainly supported by a detachment of the French Air Force. Based in Jordan and in the United Arab Emirates, it participates to the allied air strikes against ISIS. Concerning the mentorship and the training support to the Iraqis Forces, the French Army contributes to the global effort of the alliance after the reorganization of Operation Inherent Resolve command structures.

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2 Army, Air Force, Navy and Gendarmerie
BARKHANE: GLOBAL SUB-SAHARAN ANTI-TERRORIST MISSION

Operation Barkhane, spanning five countries in the Sahel region of North Africa, started in the beginning of August 2014 after the completion of Operation Serval. With their main base located in the Chadian capital N’Djamena, the FR forces are actively operating in Burkina Faso, Mali, Mauritania, Chad and Niger.

Following the murder of 6 French and 2 Nigerian civilians, the objective of the Barkhane force and its allies was to keep and consolidate the control of the region.

Operations have been consisting of raids led deep inside enemy sanctuaries combined with airborne operations and airmobile attacks.

The next challenge will be to accelerate the rise of local armed forces (Mali, Burkina-Faso, Niger, G5 Sahel Joint Force) with the contribution and the support of European, Canadian and American allies committed in the region.

SENTINELLE & RESILIENCE: HOMELAND PROTECTION

Committing 10,000 soldiers across the country, operation Sentinelle was launched to support the security forces in the aftermath of the November 2015 terrorist attacks. This operation is still ongoing.

The Operation Sentinelle still includes three responsive layers:
- a permanent operational force of 2,600 men, whose objective is to ensure permanent missions of security in the most sensitive and vulnerable areas;
- a planned reinforcement echelon of 4,400 men, helping to secure occasional or seasonal events;
- a strategic reserve of 3,000 men in the hands of the French President.

In order to support civil services who are still committed into the fight against COVID-19, the Armed Forces have adapted the layout of the operation RESILIENCE launched on March the 26th. After the lifting of many lockdown restrictions and the deconstruction of temporary structures, the Armed Forces have concentrated their efforts on the French overseas territories. Depending on the evolution of the sanitarian situation, they are also ready to be engaged in case of 2nd wave.

Today, 13,000 soldiers, airmen and sailors are deployed in France mainland and overseas territories in the frame of these two operations.
2. FRENCH ARMED FORCES HIGHLIGHTS

2.1. A STEADY BUDGET FOR THE FRENCH ARMED FORCES IN 2021

In 2021, the French Armed Forces Ministry will benefit for the third year in a row of an increased and consolidated budget totaling $59.5 billion for 2021.

The main items of expenditures of the $59.6 billion French defense budget will be:
- $47 billion of increased payment credits as planned by the 2019-2025 Military Program Act, out of which, a record $26.7 billion for modernizing equipment and buildings, $14.8 billion for wages, and $5.5 billion for operating costs;
- $10.2 billion will fund pensions.
- $2.4 billion of the total defense budget will be allocated to the government’s department focused on veterans’ affairs

Its minister, Mrs. Florence Parly recently stressed that the Military Program Act 2019-2025 has been strictly respected with an additional $2 billion. Since 2019, the French Armed Forces have had $21.7 billion more to spend than in 2017 and will benefit from a global $132 billion investment budget between 2019 and 2023.

DEFENSE CONTRIBUTION TO THE NATIONAL RECOVERY PLAN

In early June, the government revealed a series of plans aimed at specific industries severely hit by the pandemic. Even if the big four of the French Defense Industry (Airbus, Dassault Aviation, Safran and Thales) have benefited from several funds of the $18 billion aeronautics plan, the mechanisms recently set up put the priority on the future helping innovative suppliers.

Specifically designed to back the sector’s supply chain, the funded innovative projects encompass a large array like modernizing production tools, research and development efforts or digital transformation. As a reminder, France counts about 1,300 companies ranging from startups to major firms that employ approximately 300,000 people in the aeronautics sector.

In this context, the Armed Forces Ministry is committed in the immediate response to the economical aftermaths of the pandemic bringing sufficient workload to the aeronautics sector through a $1.01 billion spending envelop:
- Anticipated order for three A330 Phénix multirole tankers;
- Early order for a light surveillance and reconnaissance aircraft;
- Early order for eight H225M Caracal helicopters for the Air and Space Force;
- Early order for a naval airborne drone system and an onboard mini-drone;
- Early order for 12 helicopters, two EC-145s and 10 EC-160s, for the Gendarmerie and the civil security forces.

The ministry’s contributions also include $360 million in subsidies for suppliers and subcontractors, and $1.8 billion spent over the next three years to support Research, Development and innovation.

THE MAIN PROJECTS FUNDED IN 2021

Under the defense budget, the Army will procure:
- 12,000 HK416F assault rifles (and order another 12,000);
- Five Caiman helicopters (and order 21 light joint helicopters);
- 20 Jaguar armored vehicles, 157 Griffon armored vehicles, 80 renovated VBL light armored vehicles (and order another 120) and 1,000 VLTP light tactical multipurpose vehicles;
- 850 portable radios (and order 2,900); and 925 vehicle radios (and order 7,300);
- 200 MMP medium-range missiles and 75 firing posts;
- 10 SDT tactical drones.

The acquisition of 300 AFV Jaguar and 1872 IFV Griffon is planned with the SCORPION Program.
For its part, the Navy is going to procure:
- A FREMM multi mission frigate (and ordering an intervention and defense FDI frigate); and an upgraded light stealth frigate.
- A Caiman helicopter (and ordering eight HIL light joint helicopters).
- Three upgraded ATL2 patrol aircraft.
- Aster 30 missiles, F21 Artemis torpedoes, Exocet MM40 Block 3C anti-ship missiles (and ordering 45 Exocet kits).

The Air & Space Force is acquiring:
- An Atlas A400M transport aircraft, three A330 Phénix multirole tankers, two upgraded C-130H transport aircraft, 14 upgraded Mirage M2000D fighters and one H-160.
- 14 Talios laser designation pods;
- 90 upgraded Scalp missiles, 367 MICA New Generation air-to-air missiles, 150 Mica New Generation training systems;
- Six SCCOA Mk4 radars;
- Specifically for the space segment, a Musis / CSO satellite, 15 Syracuse IV ground stations, and one Ceres satellite system.

As a complement, it is noticeable that the new “Mentor” fighter pilot training cursus and the future combat air system demonstrator, which constitute two major programs, will be launched in 2021.

2.2. “DO DIFFERENT”: GENERAL THIERRY BURKHARD’S MOTO

Since the official release of its strategic plan for the French Army, “2030 Operational Superiority”, its Chief of Staff, General Thierry Burkhard, has given several interviews to share his vision and explain the way he wants to transform the Service. To unleash, develop and guide all the energies needed to complete this critical mission, fighting spirit and leadership seem to be the first elements of his ambitious and human-centric answer.

Considering the evolution of the international security environment, the more common use of coercion below the state confrontation level and the relative degradation of western armies’ technological advantage, the time has come to build a hardened model able to operate units in mass within a complete spectrum of environments and domains. Tomorrow, the future conflicts would probably mix hybrid warfare, insidious attacks, manipulation of the perception and risk of regional escalation.

In this context, French Army COS’s objective is to propose in 2021 a new strategic offer to the French Joint COS for the 15 coming years. The aim will be to better combine the action of the Service with the other ones within the classical domains, land, air, sea. However, it will be also the opportunity to widen its action to the new domains like cyber or space.

In addition to this qualitative objective, a huge quantitative effort to scale the French Army will be needed to conduct operations against peer or near peer enemies. To take up this double challenge, the answer will lie not only in doing more but certainly in doing differently. These general considerations enlighten in a specific way several strategic general Burkhard’s projects focused on the human.

Main mid-term goal in the training field, the live division-level exercise planned in 2023 is one of the first milestone on the new path taken by the French Army. In partnership with allies and partners of France, the deployment of a complete and wide array of modernized capacities in the framework of a high intensity warfare scenario will embodies the will to learn back concretely the science and the art of huge unit maneuvers. To achieve this desired shift of mindset and be on time on target, the French Army can count on its pool of training camps in Champagne where rotations will be more focused on battalions deployed with all their assets and supports.
However, all these efforts might remain vain and fruitless without a strong and renewed leadership combined to smart technical abilities. To make possible this evolution on the long term, the initial training of the leaders will be reviewed and consolidated. Thus, a new NCO technical school dedicated to sensitive and critical military specialties, as cyber, is to be set up. Through this new generation of highly qualified technicians, the objective is to give the Army the manpower it needs to operate in all the domains of current and future conflicts.

At the same time, a deep modernization of the officer training has just been kicked off. Firmly led by the Saint-Cyr Coëtquidan Schools commanding general, this transformation is to forge the future leaders capable of deciding despite a versatile and volatile environment. One of the core competencies targeted will be their ability to think and develop the effect approach required by the new profile of the conflicts. In particular, general Thierry Burkhard wants to develop the young officers’ taste for deception tactics and maneuvers thanks to a stronger awareness of perceptions. Without forgetting the difference in terms of scale, operation Fortitude is a masterpiece that must be more taught and used for military thinking or wargames.

To conclude, French Army COS aims an Army able to operate in all domains of the conflicts in close coordination with its allies and manned by a highly competent and proactive personnel. To take up the challenge, it is necessary more than ever to work harder and differently with the will of success.

2.3. The Transformation of the French Army Officers’ Training

Following the French Army Chief of Staff’s intention to renovate leadership, the Saint-Cyr Coëtquidan Schools has initiated an ambitious reform of the officers’ initial training curriculums. Based on proven experience, the “ESCC3 2030” project aims to better shape future officers’ human thickness and technical competency.

In the framework of a large review conducted by the French Army officers’ Mother School, the confrontation of the current training model to the new profile of conflicts, the return of force, the social and technological evolutions resulted in the identification of four driving challenges of the reform:

- The challenge of Combativity: the ESCC want to shape hardened, pragmatic, audacious and resilient officers mentally, morally and intellectually stronger;
- The challenge of Leadership: forge federators of energy. To achieve this goal, the programs will better teach how to obey with intelligent discipline, led by example and decide despite uncertainty;
- The challenge of Intelligence. In this domain, intellectual agility, culture, learning and understanding abilities will be the key elements;
- The challenge of Humanity. To face the rise of violence, the renovated education intends to better develop the future officers’ ability to think on the sense of their action and the cardinal values that drive their commitment. For that, discriminate, personify and transmit will the main abilities developed.

Relying on a proven integrated model that provides military and academic instructions at the same location, the ESCC will base their renovation on two pillars: education and maturity. Their development through renovated academic learning, military teaching and human education will draw the new educational matrix.

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3 ESCC = Ecoles de Saint Cyr Coëtquidan = Saint Cyr Coëtquidan Military Schools responsible for the initial training of the French Army officers. On the same location the Saint Cyr Academy for the direct recruitment, the Ecole Militaire Interarmes, Combined Arms Military Academy, that trains young NCOs selected to become officers and the IVth Battalion that trains all the contract officers.
3. FROM THE FIELD

3.1. BARKHANE: MORE AGILITY TO KEEP CONTROL ON THE ENVIRONMENT

Running from July to late October, the rainy season currently affects the Sahelo-Saharan strip. It makes the land partitioned and difficult to use with pronounced wadis that are difficult to cross. To maintain the pressure on the terrorist groups, the Barkhane Force has adapted its operations to overcome these specific environment constraints.

In these conditions, the use of high mobility vehicles as the VHM (Véhicules Haute Mobilité), air assaults, helicopter raids in depth and airborne operations has been the most valuable assets into the fight. In particular, the recent replacement of the iconic Transall C160 by the Hercules C-130J boosted the ability of the allied force to project unit on short notice.

Therefore, the operational tempo has not been reduced or weakened. The number of allied troops deployed on the battlefield has been maintained. This agility and tactical versatility allowed Barkhane to maintain its control on the area of operation.

As an example, the Desert Battle Group Bruno carried out by night Airborne Operations (OAP) to deploy reinforced company-size elements. Tasked to secure a key pint, this unit was one of the troops that facilitated the engagement of larger allied and partner forces including the Malian Armed Forces.

3.2. French Navy is ready to take alert for Maritime NATO Response Force

Despite the challenges posed by the pandemic, the naval exercise Dynamic Mariner-20 (DYMR20) took place as initially planned off the coast of Toulon (France), from Sept 28th to Oct 8th, 2020.

DYMR20 is the main live Exercise (LIVEX) in the maritime domain led each year by MARCOM, the NATO Maritime Command, to train the MCC for the coming year in the framework of the NATO’s Response Force Maritime Component (NRF/M). The main goal was to certify French Maritime Force (FRMARFOR) located in Toulon, as the next commander of the NRF/M in 2021. It will be the 5th time that French Navy takes its turn of alert that usually lasts one year, the next not yet being scheduled before 2026.

Seven nations (Belgium, France, Greece, Italy, Netherlands, Spain, and the United States) participated to the exercise involving 31 surface ships, 1 submarine, 3 maritime patrol aircraft and other air assets, alongside the two NATO standing naval Forces, the NATO Maritime Group Two (SNMG2) and Standing NATO Mine Countermeasures Group Two (SNMCMG2).
3.3. **END OF MISSION FOR OPERATION AMITIÉ UNITS**

Initiated in the immediate aftermath of the explosions occurred in Beirut on August 4, operation AMITIÉ has been embodied the commitment of France to support Lebanon and the solidarity of the French people toward the Lebanese population.

In addition to the French contingent of the UN Force in Lebanon, the French Army has actively contributed during 8 weeks to the emergency response disposition and the first reconstruction works within the devastated areas.

To respond to the emergency, soldiers of the UIISC1\(^4\) were sent to contribute to the first aid lay out bringing their expertise of crisis situations. Used to operate in France and abroad following natural or industrial disasters, this unit is part of the French Army and belongs to the Engineers branch.

On the same time, the Engineer Group Ventoux was deployed with approximately 100 construction machines to contribute to the safety of the harbor and participated to the hangars area cleaning operations that are currently in their final phase. In the city area, the Sapeurs\(^5\) also intervened in schools to allow a quick return to school.

Contributing to the very first steps of the long-term reconstruction, the French Army also sent engineers from the Defense Infrastructure Service. Their mission was to provide technical expertise and support to the Lebanese Armed Forces and civilian authorities. In coordination with their partners, they conducted structural assessments of public buildings for the benefit of the Beirut municipality crisis unit. Thus, some French experts participated to the evaluation of the Rosary Hospital structure established in the perspective of its forthcoming refurbishment.

3.4. **The French Navy contributes to the fight against drug trafficking in the Caribbean Sea.**

During the night of September 24-25, the French Navy frigate Germinal intercepted 60 kg of cocaine (=2.5M$) off the coast of Dominica.

For a few hours, a suspected transshipment at sea had been monitored from the air by US Navy maritime patrol aircraft and aircraft of the Regional Security System Organization in the Eastern Caribbean. Tasked directly by Joint Interagency Task Force South (JIATF-S), the two aircraft positioned themselves in support of the frigate Germinal and guided the frigate to their target in order to conduct an interdiction operation.

The frigate’s helicopter was responsible for stopping the Go Fast. After warning shots, the helicopter was able to observe a drop of several bags. Drug traffickers very often use this tactic to avoid being caught. These bags sank and could not be recovered by the crew.

An initial analysis showed that the quantity of drugs dropped was about 60 kg of cocaine worth 2.5 million dollars.

\(^4\) UIISC1 : Unité d’Intervention et de Sécurisation de la Sécurité Civile n°1 = Civil Security Instruction and Intervention Unit N°1

\(^5\) Sapeurs = Engineers
This success is the result of efficient and daily cooperation between the French Armed Forces in West French Indies and the Joint Inter Agency Task Force (JIATF) South who cooperate in the area in fighting against illicit maritime and aeronautical trafficking in drugs and psychotropics substances in the Caribbean area.

"It was a remarkable team effort," said RADM Hausermann, Commander French Armed Forces in the Caribbean area.

3.5. FIRST DEPLOYMENT IN AFRICA FOR THE GRIFFON

Prior to its first operational deployment in Mali in 2021, the GRIFFON has been evaluated for two weeks in Djibouti well known for its severe environmental conditions.

Arrived on September 10, the two Griffon vehicles have followed an intense program of evaluations to test their capacities in desertic conditions. The campaign was composed of three main blocks of tests: mobility, on-road and off-road, firing and communication systems. At the end of the campaign, every system had been tested on the ground and the results allow to consider the projection in Mali with confidence.

As a reminder, the Military Program Act 2019 – 2025 plans the procurement of 1,872 GRIFFON type vehicles by 2030. Half of them are planned to be delivered by 2025.

3.6. TRAINING IN PACIFIC FOR FRENCH INFANTRYMEN

From September 14 to 17, 2020, the Pacific Polynesia Marine Infantry Regiment (RIMaP-P) carried out the SAUVAGES 2020 exercise in the Tahiti peninsula that belongs to the TARAVAO region (southern part of the island of Tahiti).

Conducted on a yearly base at the antipodes of metropolitan France, it offers a very unique training environment.

Ahead of the hurricane season, the exercise encompassed several objectives: work coordination in a joint scenario with the air and marine components of the Armed Forces in French Polynesia (FAPF), check and improve the regimental Command Post procedures and harden the troops.

The soldiers of the Armed Forces in French Polynesia (FAPF) and the Armed Forces in New Caledonia (FANC, mainly manned and equipped by the Navy) represent the French sovereignty forces in this part of the Pacific. These units allow France to develop military cooperation in the region but also to ensure missions devolved to the bordering nations of the Pacific as post-disaster assistance mission or fight against illegal trafficking.
INTERNATIONAL COOPERATION CORNER

4.1. FRANCE IS REORGANIZING ITS SUPPORT TO IRAQI FORCES

For France, there is no question of letting their guard down against the residual forces of the Islamic State as proved by the increasing number of airstrikes carried out by the Rafales of the Chammal force detachment.

After a pause due the Covid pandemic, the French Minister of the Armed Forces, Florence Parly, visited Bagdad at the end of August 2020 to resume the partnership initiated with the Iraqis Armed Forces. According to her, the aim is clear: help Iraq to hit strongly terrorism that has reinforced its positions during last months.

Concretely, Mrs. Parly reaffirmed that France stands ready to continue the training undertaken with the Iraqi forces fighting on the front line and to participate in the rise of the Iraqi security forces. She also pointed out that the training and mentorship support, offered by France in the framework of the coalition, must now evolve and be reorganized.

Therefore, the “combat training function” has been completely transformed. A global entity, the Military Advisory Group (MAG), is in charge of the advisory policy provided to the senior Iraqi military authorities. It includes in particular the joint operation center - Iraq (JOC-I) and the operation command center of the Iraqi General Staff. At the same time, this mission has been entrusted to a new body: the Joint Operations Advisory Team (JOCAT), which is an advisory team for the joint operations command. Located in Bagdad, it will be headed by a French colonel and will count around thirty men.

4.2. POOLING AND SHARING LOGISTICS IN LITHUANIA

Part of the German-led multinational battalion deployed in the framework of the NATO Enhanced Forward Presence lay-out in Lithuania, French soldiers actively contribute to the international logistic support provided to the units of the battle group.

Multinational branch of the general staff, the S4 of the EFP Battle Group in Lithuania is led by a German whose deputy is a Dutch officer. French and Norwegian officers assist them in the planning and the execution of troops and equipment movements or supply operations.

According to the multinational partners, mutual understanding is critical to achieve the necessary coordination between the different nations and back the units on the field. Backbone of the ground alliance forces in the area; the Luxembourg logistics detachment embodies the multinational cooperation allowed by common and shared procedures. Increasing the ability to operate together, this approach obviously consolidates interoperability within the alliance for the success of the mission.
5. **INNOVATION CORNER**

5.1. **ENHANCES STRUCTURES FOR INNOVATION**

By the voice of its Minister, the French Ministry of Armed Forces announced the achievement of another step in its modernization through the promotion of Innovation.

On September 8, Mrs. Florence Parly revealed in Lorient new elements of the Ministry strategy included in the Military Program Act that plans to increase by 25% the funds dedicated to innovation.

In her speech, Mrs. Parly declared that the Ministry will annually allocate $1.2 billion to support the development of disruptive technologies considered as critical for the strategic self-sufficiency of the country and the preparation of the future capabilities of the Armed Forces. From an institutional prospective, the main announcement was the creation of the investment fund Definnov in partnership with BpiFrance. In addition to Definvent ($122 millions), the fund has been endowed with $245 million to support the development of dual technologies through the equity financing of innovative companies.

In 2019, energy, artificial intelligence, space and cyber were the priority domains. In 2020, priority is given to the hypersonic field, anti-drone warfare, directed energy weapons (lasers and electromagnetic technologies), advanced sensors and quantum technologies.

5.2. **DVE SOLUTION FOR THE CAIMAN STANDARD 2**

Merging advanced technologies developed by Airbus Helicopter, Thales Avionics, Safran Electronics & Defense, the French Army Aviation is currently evaluating a solution to offer helicopter crews a potentially disruptive solution for flying, landing and fighting in degraded visual environments.

The evaluated systems will equip the first 10 CAIMAN (NH90) Standard 2 the French Army has just ordered.

Originally requested by the French Army Aviation Special Forces, the combination of the Thales’ TopOwl HMSD-DD, the Safran’s Eurofl’Eye (DSA + EUROFLIR 410) and the Synthetic Vision System from Thales (3D digital map) was presented for the first time during the Eurosatory international defense and security exhibition in June 2018. Association of a panoramic and multispectral 3D pilot-aid sensor with an advanced FLIR, Eurol’Eye offers high definition images to the flying crew. Designed to enable augmented reality, this equipment is to constitute a real revolution in the way of flight and military operations by providing the crew a 200-degree view projected in a high definition and stereoscopic infrared image. Thanks to the last digital display version of the TopOwl’s, the full performance of the sensor delivers an accurate infrared image and push back the limits of night flight.

The first flight tests carried out by the French Army Aviation flight test group on the NH90 Caiman have been highly promising. In 2020 and 2021, the following steps will also include the evaluation of the tactical capabilities of the EUROFLIR 410 whose information can be fused and displayed through the Eurofl’Eye system. The generated synthetic high definition picture will be displayed in real time and superimposed on the actual terrain vision, drawing information from integrated databases as GPS data, digital cartography, the Pilot’s Line of Sight (LoS) measurement or from the aircraft’s sensors. Incorporating a high quantity of functions in a compact package, the Euroflir 410 associated with the TopOwl, the Eurofl’Eye and the Synthetic Vision System will provide augmented reality information right in front of the pilots’ eyes. The load master and the warriors transported will also be in the tactical loop through screens and tablets.

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6 BpiFrance = Banque Publique d’Investissement France = French Public Bank of Investment
7 HMSD-DD = Helmet Mounted Sight Display – Digital Display
8 Distributed Aperture System = wide field camera system
At the end, the whole solution is to offer four decisive advanced functions for the NH90 CAIMAN’s crews: more accurate vision under degraded flight environment, better situation awareness, facilitated targets detection and an improved targets identification.

As a reminder, these technologies will be integrated to the CAIMAN Standard 2 delivered to the French Army Aviation Special Forces early 2025. The lessons learned in operation will be then exploited for the NH-90 CAIMAN Standard 2 fielded within the conventional forces.

5.3. **DRONES FOR SMARTER AIRCRAFT MAINTENANCE**

An innovative firm of Toulouse is to boost the efficiency of aircraft maintenance teams combining drone inspections and big data.

Developed in the framework of a 12-month contract of a research & development funded by the Defense Innovation Agency in November 2019, the first evaluation campaigns have been highly promising.

To simplify and accelerate inspection operations, the young innovative company Donecle created a semi-autonomous aerial inspector. Designed for a large array of metallic or composite materials, this drone is equipped with ultra-sound sensors. Designed to detect any external or internal defects on the surface of an immobilized aircraft, it generates automatically inspection reports. Its main targets are well known coating damages and internal cracks. Developed in partnership with Dassault Aviation and 8Tree, the robot allows automated inspections and reduces dramatically the time needed for maintenance operations. Tested on civilian planes and operated by a single operator, the Donecle drone was able to realize surface inspections in about twenty minutes when 15 technicians and almost an entire working day are necessary with traditional process and techniques.

After being evaluated on a E3F AWACS aircraft, the Donecle drone has just been associated to several phases of the new Rafale F4 evaluation. The aim was to combine the new 3D digital cartography of the aircraft to the inspection abilities of the drone. As the previous ones, the first tests were particularly conclusive. In addition to the maintenance resources optimization, the solution will bring better availability and more air safety within the operational units.
As a reminder, the Rafale F4 standard will have a new prognosis and diagnostic aid system introducing predictive maintenance capabilities. Combined with artificial intelligence and Big Data, this kind of automated solutions are called to be part of the new maintenance digital environment of the next generation aircrafts.

5.4. **INNOVATE FOR A BETTER MEDICAL SUPPORT ON THE FRONT LINE**

Committed to support the French Armed Forces, the Armed Forces Health Service (SSA⁹) is permanently improving its procedures and equipment.

In this perspective, the SSA has recently fielded two solutions to provide a better medical service closest as possible to the deployed soldiers.

**Improved close surgical support**

**Key element in the medical support of operations, the surgical units are specialized care structures deployed close to the frontline.**

Inspired by the WWI "autochirs" (surgical units mounted on light vehicles), the medic paratroopers of Indochina and Algeria (1950’s and 60’s), the ACA¹⁰ 84s and 05s, the ARCS¹¹ is the fourth generation of surgical forward assets.

Since their last transformation in 2005, the staffing of the mobile Surgical Teams has increased significantly, without increasing decisively their capacity to deal with very severe trauma or multiple casualties. During the same period, two needs have clearly emerged: the ability to treat two wounded persons with more complex and multiple injuries and the capacity to move more quickly. Therefore, redesign the surgical support deployed on the front line was necessary in order to better match the needs and exploit the conclusions of the most recent epidemiological studies.

Fully interoperable with the medical chain, the ARCS provide enhanced surgical abilities as close as possible to the Point of Injury. Integrated in the continuum of the casualty care, it allows the simultaneous treatment of 2 severe wounded, both in terms of Critical Care and Surgery. Over one day, its treatment capacity can be 8 surgical casualties. If the number of caregivers remains more or less the same, 13 persons, its operational and medical capacities are higher. The reinforcement of an additional surgeon specialized in "head and neck" (one third of casualties) represents another great added value.

For its part, mobility is ensured by a medical-surgical squad (10 persons) of the Medical Regiment (RMed) mounted on 2 heavy logistic trucks and 3 light infantry vehicles. Deployable within 2 hours, the whole structure can run 48 hours in autonomy for a reduced logistical weight (5 tons, 27 m³). Finally, its versatility allows the SSA to use it as the beating heart of a larger medico-surgical structure on an operational logistics platform.

**A new solution for the Special Forces**

Designed and developed by the Health Engineering Department of the SSA, a compact and ultra-light medical oxygen cylinder is to equip Special Forces units and replacing the former bottle (3-liter capacity under 2,900 PSI, 200 bars, 15 lbs. weight, bag and accessories included).

The challenge was to develop an ultra-light device containing 1 liter of medical oxygen under very high pressure (4,300 PSI, 300 bars). The cylinder, specifically developed for this project, has a carbon filament winding and does not exceed

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⁹ SSA = Service de Santé des Armées = Armed Forces Health Service;
¹⁰ ACA = Antenne Chirurgicale Avancée = Forward Surgical Unit.
¹¹ ARCS = Antenne de Réanimation et de chirurgie de sauvetage = Resuscitation and Rescue Surgical Unit
1.8 Lbs. In the end, the compact bottle (16.5 inches high, 4.7 inches diameter) weights 5 lbs. including the oxygen load. Usable from -40°F to 150°F, with an autonomy of 30 minutes, it can even be slipped into a backpack or worn on a belt.

Evaluated by Army Special Forces units in operation, this cylinder provides a source of medical oxygen as close as possible to the combat zones, without increasing significantly the Nurses or Physicians’ carrying load.

6. **THE FRENCH ARMY VOL.6: THE MAINTENANCE**

6.1. **GENERAL ORGANIZATION**

**Within the French Armed Forces, the global maintenance architecture obeys to two main principles.**

First, it is shaped following a functional logic organized around three essential missions:

- Project Management (Maitrise d’Ouvrage = MOA);
- Delegated Project Management (Maitrise d’Ouvrage déléguée = MOAd);
- Work Control (Maitrise d’œuvre = MO), State Operational Work Control (Maitrise d’œuvre opérationnelle étatique = MOé), State Industrial Work Control (Maitrise d’œuvre industrielle étatique = MIé), Private industrial Work Control (Maitrise d’œuvre industrielle privée = MIp).

Then, the global structure of maintenance responds to a logic of environment:

- The Land environment entrusted to the Army;
- The Aeronautical environment entrusted to the Air Force;
- The Naval environment entrusted to the Navy Staff.

In accordance with the organization’s principles of the Armed Forces’ maintenance, the Armed Forces Chief of Staff (CEMA) delegates to the Army Chief of Staff (CEMAT) the responsibility of the performance and the control of the maintenance for the land equipment. To complete his mission, he’s assisted by a strategic pillar of the Army, the Integrated Structure for the land equipment maintenance (SIMMT). Delegated Project Manager, the SIMMT works for the other Services, Departments which are the Project Managers. For the land environment, the maintenance is organized in two support levels:

- Industrial support level provided by the Army support bases (BSMAT) or by industrial partners.
- Operational support level provided by specialized combat units, within the Army’s battalions or in the specialized maintenance battalions (Régiments du Matériel = RMAT) that belong to the Forces Maintenance Command chain of command (Commandement de la Maintenance des Forces = COMMF).

The land industrial maintenance service (SMITer) is the industrial work control organism. It carries out the industrial maintenance operations entrusted by the Integrated Structure for the land equipment’s maintenance (SIMMT) with its equipment support bases (BSMAT). The SIMTer gathers 2,300 men in three different bases.

Under the organic authority of the Land Forces Command (COMFT) and the functional authority of the Integrated Structure for the land equipment’s maintenance (SIMMT), the Forces Maintenance Command (COMMF) is in charge of the operational work control. It guarantees to battalions and Army’s organisms
the qualitative and quantitative provision in land equipment, material and human maintenance resources necessary for the well execution of their operational missions and training activities. The COMMF gathers 11000 men in one headquarter six specialized battalions and one technical school.

6.2. MAINTENANCE IN OPERATION
Organized in three levels, the maintenance overhaul mission in operation is to preserve and maintain the unit combat power and capabilities.

6.3. MAINTENANCE LEADERS
Relays of senior leaders and guardians of the maintenance objectives, maintenance officers are tasked to:
• Find solutions in case of undersized maintenance structures;
• Measure the consequences of equipment over-consumption on the maintenance capacities;
• Consolidate planned maintenance periods for assets users to preserve a 90%, technical availability before a major operation;
• Ensure that the first line users are well doing the everyday preventive maintenance;
• Try to anticipate maintenance infrastructures needs before deciding a deployment;
• During the joint operations planning group phase, highlight the maintenance issues to choose the best course of action.