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1.1 Background and key dates

ENDOCONTROL specializes in robotic assistance for laparoscopic surgery. The company works with and for surgeons to develop “cobots” (collaborative robots) for laparoscopic procedures.

Laparoscopy is a surgical technique performed with long and fine instruments inserted into the abdomen through a cannula. The procedure is performed under video control, with a camera and an endoscope inserted through the umbilicus.

Although laparoscopic surgery has many benefits for the patients (minimally invasive procedure associated with less scarring and less pain, shorter operating time, improved recovery, etc.), it is technically more difficult for surgeons and potential complications may limit its applications.

For this very reason, ENDOCONTROL develops and distributes a range of products aiming to aid the surgeon in minimally invasive surgery: VIKY EP, a motorized endoscope positioner for laparoscopy, VIKY UP, a motorized uterus positioner, and JAIMY, the first articulated robotized instrument for 5-mm incisions.

A 10-year collaboration with surgeons, 3 product ranges on the market, and 150 robots currently in service worldwide

Clément Vidal, a 37-year old engineer, graduate of France’s Ecole Polytechnique and of Stanford University in the United States, started his career in the early 2000s working for a large pharmaceutical company in London. Very soon after that, he transferred to the quickly evolving field of surgical robotics.

In 2004, he met a business developer Patrick Henri. Together, they decided to create ENDOCONTROL: ENDO for endoscopy, CONTROL because their new-generation robots were set to provide surgeons with greater precision of movement. The company was created in 2006 with Clément Vidal as CEO.

ENDOCONTROL set up in La Tronche, near Grenoble in France, in a business incubator located a stone’s throw from the University Teaching Hospital of Grenoble. The robots are developed in partnership with University Joseph Fourier, University Pierre et Marie Curie, and specialist teams in digestive and urological surgery, particularly the one at Institut Mutualiste Montsouris in Paris.
ENDOCONTROL will celebrate its 10th anniversary next year, after several key developments along the way:

- **2000-2005** Research project conducted at TIMC-IMAG laboratory of University Joseph Fourier (Grenoble).

- **2005-2007** Industrial development of VIKY by ENDOCONTROL.

- **2007** Commercial launch of the VIKY robot following European CE mark certification.

- **(December) 2008** Accreditation by the FDA (US Food and Drug Administration) for VIKY EP, the endoscope positioner version of the VIKY robot, thereby opening up the US market.

- **2011** Accreditations from Russia, Canada and Japan obtained for the VIKY robot, and CE mark granted to the motorized, articulated instrument JAIMY.

- **2012** Distribution agreement signed for the VIKY system, which accelerated its market penetration significantly.

- **(January) 2013** Distribution of VIKY extended to the Middle East and Africa, and later to 6 countries in South East Asia (Taiwan, Korea, Thailand, Singapore, Malaysia and Indonesia).

- **(June) 2013** FDA approval granted for VIKY UP, the uterus positioner version of the VIKY robot.

- **(July) 2014** ENDOCONTROL won an award at the Global Innovation Competition, in the category of Individualised Medicine. Its project on surgical cobots ARCC (Assistance Robotique de Co-manipulation pour la Chirurgie), based on intelligent communication between the robot and the surgeon, was selected by the Innovation 2030 commission chaired by Anne Lauvergeon.

- **2015** In partnership with ISIR, Institut Mutualiste Montsouris and Haption, ENDOCONTROL won the Integration Award of the first Competition on Collaborative Robotics, on the theme of man/robot collaboration and cobotics in the workplace, for the laparoscopic surgical assistant Achille, VIKY EP and JAIMY.

Manufactured in France (Rhône-Alpes region), 150 ENDOCONTROL robots are currently in service in hospitals in Europe, the United States, the Middle East and Asia.

“ENDOCONTROL has always clearly targeted international markets,” declared Patrick Henri, VP Business Development. “It is true that we started working with local and regional establishments, but we always had our sights set on the global market, and we have now opened an office in Boston, Massachusetts.

This is why from day one, we build versatility into our products to fit all ergonomic parameters. For instance, something seemingly universal such as hands: our instruments must fit American as well as Asian surgeons, women as well as men.”
1.2 Three questions to Clément Vidal, CEO of ENDOCONTROL

What do you see as the end-purpose of medical robotics?

“A major objective of surgery today is to be less invasive and less aggressive to improve patients’ recovery, reduce pain, and improve healing. To achieve this, surgeons must make increasingly smaller incisions, which puts more and more constraints on their freedom of movement and at the same time demands greater precision. I am convinced that robotics can address this issue. Many surgeons are still waiting for results to be confirmed, and it often takes a long time to convince them to change their practices. Nevertheless, there is no doubt that robot-assisted surgery will play an increasingly important role in operating rooms.”

Can you explain how JAIMY was started?

“It started with a demand from surgeons and an analysis of their needs and their constraints. Given the numerous technical challenges this raised, we worked jointly with the ISIR laboratory of University Pierre et Marie Curie to find adequate technical solutions. This technology is currently protected by four patent families. Then came the development and validation phase, which was challenging because operating rooms are subject to many constraints and regulations.

The first surgical procedure using JAIMY was performed by Pr. Brice Gayet at Institut Mutualiste Montsouris in December 2011. It was a success. However, another three years of development were necessary to meet all the demands of surgeons and healthcare teams. The investment was considerable, and I am proud of this industrial, academic, and clinical collaboration, which brought to the market and in operating rooms the first robotic laparoscopy instrument able to work through 5-mm incisions. Our hope is now that a patients all over the world will benefit from it.”

Does France have the skills and strengths to meet these challenges?

“Closing the leadership gap in telemanipulation technologies with the American da Vinci System would require very significant investments. Therefore, focusing on the challenges of comanipulation systems for abdominal surgery may be a worthwhile option for us. Fortunately, France has top-level academic laboratories in this field (ISIR, TIMC-IMAG, LIRMM, LSIIT, recently grouped under LABEX CAMI), and a few innovative SMEs, of which we are one, which have the expertise as well as portfolios of innovative patents. With this in mind, we developed (in partnership with ISIR and Pr. Brice Gayet of Institut Mutualiste Montsouris) a hybrid robotic instrument called JAIMY. Like conventional surgical instruments, this robotized instrument is held by the surgeon’s hand, and not by a robotic arm.

We believe that France has the required talents, technology and intellectual property to embark on this endeavour, and thereby regain ground in this high-growth strategic market.”

“It’s started with a demand from surgeons and an analysis of their needs and their constraints.”
ENDOCONTROL develops a range of new-generation surgical assistance robots, dedicated to minimally invasive procedures (incisions less than one centimetre). Designed in collaboration with surgeons, these instruments provide solutions to their specific constraints: limited space in the sterile fields, adaptability to different anatomies, need for surgeons to stand close to the patient, etc.

With its product portfolio, ENDOCONTROL optimizes the collaboration between practitioners and robots, thus optimizing both human capacities (medical knowledge, adaptability, flexibility, etc.) and robotic capacities (precision, stability, reproducibility, miniaturisation, etc.).

ENDOCONTROL is committed to finding solutions to societal challenges through the development of minimally invasive and outpatient surgery. Its surgical instruments are designed to work through very small incisions to minimize scarring and pain, and at the same time make surgeons’ work easier.

2.1 The robotized systems, endoscope positioner VIKY EP and uterus positioner VIKY UP

The motorized endoscope positioner VIKY EP was the first robot created by ENDOCONTROL in 2007. With VIKY, surgeons operate under direct vision and are able to position the endoscope without any assistance. Through a multilingual voice-activated interface connected to a wireless microphone, surgeons speak to the system to move the endoscope to the desired positions, thereby optimizing the exposure of the surgical site.

The revolutionary architecture of VIKY developed by and for clinicians is perfectly suited to the constraints of surgery. Lighter and more compact, VIKY improves the operator’s postural comfort whilst remaining compatible with conventional instruments and techniques. It is therefore applicable to a wide range of procedures, for the benefit of patients.

In 2010, the VIKY system was adapted for uterine manipulation. VIKY UP is a robotized uterus positioner, designed for gynecological procedures.

- VIKY EP (Endoscope Positioner) provides extremely stable images, and it eliminates camera shake and associated eye fatigue, especially during longer procedures.
- VIKY UP (Uterus Positioner) is designed to give surgeons excellent control on uterus positioning, a necessity during the procedure’s critical stages to improve tissue exposure.

“Laparoscopy is a real challenge, especially as it is moving towards increasingly complex and long-lasting procedures. With the VIKY EP system, I can overcome all endoscope-related issues: shaky images, lack of position control, and fogging or soiling of the endoscope lens. Indeed, after a few hours, it is impossible for a human assistant to maintain the position of the camera. The VIKY system frees a hand in the O.R, which leaves me with more space to work in and frees my assistant to do other tasks while I am operating.”

Pr. Brice Gayet, Digestive and HPB Surgery
Institut Mutualiste Montsouris (Paris, France)
VIKY is INNOVATIVE

• VIKY is a unique system on the laparoscopy market which enables surgeons to control their working space through voice commands;
• VIKY is improved constantly thanks to partnerships with research laboratories and healthcare facilities.

VIKY makes surgery EASIER

• Surgeons position the robot as they wish using multilingual voice-activated control;
• Intraoperative positions can be memorized and easily recalled during the procedure for consistent and flexible positioning;
• VIKY is fixed to the rail of the operating table so the table can still be moved during the procedure;
• VIKY provides a valuable contribution to the training of residents, who can concentrate on the use of instruments.

VIKY is ERGONOMIC

• The system’s compact design frees space in the OR;
• With VIKY, the surgeon works at the bedside, in direct contact with the patient.

VIKY is VERSATILE

VIKY is designed to meet all needs.
• VIKY is fully integrated in the surgical workflow, as it is highly compatible with other systems and the tools developed for laparoscopy over the past 25 years;
• VIKY can be used either as an endoscope positioner (VIKY EP) or as a uterus positioner (VIKY UP);
• It has multiple clinical applications: gynecology, urology, bariatics and general surgery.

VIKY is INTUITIVE

• Easy to install & use, the OR staff becomes proficient in no time;
• The multilingual wireless voice control is easy to learn;
• At any time, the surgeon can move the system manually.

VIKY is ECONOMICAL

• Minimally invasive surgical procedures can now be performed by a small team;
• VIKY is the least expensive robotic system on the market;
• VIKY is fully autoclavable and reusable in compliance with the medico-economic constraints of healthcare establishments.

“I have been using the VIKY arm for 8 years and I have fully adopted it. Not only is it very simple to use, the endoscope also remains remarkably stable throughout the procedure, which is impossible to achieve when an assistant holds the camera. With VIKY, I am the one controlling the endoscope with precision and flexibility. I currently use VIKY for most of my laparoscopic procedures.”

Dr. David Klifa, Urology Surgery
Clinique Saint George (Nice, France)

“VIKY UP provides stable and optimal uterus positioning throughout the procedure. I believe it is the ideal assistant, and I use it for most procedures requiring a uterus positioner.”

Dr. Gavillon Nicolas, Obstetrics and Gynecology Surgery
Polyclinique Saint André (Reims, France)
2.2 JAIMY, the articulated and motorized instrument

After 6 years of collaborative research and development with Pr. Brice Gayet, a specialist in general and hepatobiliary surgery at Institut Mutualiste Montsouris in Paris, ENDOCONTROL launched in 2014 a new articulated and motorized instrument: JAIMY.

With the launch of JAIMY, ENDOCONTROL created a new approach to robotics: hybrid robotics or “comanipulation” robotics.

The technical specifications of JAIMY robotic instrumentation were entirely designed by experienced laparoscopic surgeons. To meet their exact needs, a technological breakthrough was necessary.

JAIMY is the first 5mm robotic laparoscopic needle holder. Featuring bi-directional flexion and unlimited axial rotation of its end-effector, JAIMY has access to difficult areas inside the abdominal cavity. It restores the freedom of movement lost with laparoscopic surgery, without increasing the size of the incision, and thereby simplifies complex operating procedures.

JAIMY is INNOVATIVE

JAIMY was designed in science laboratories by and for laparoscopic surgeons.
• JAIMY is the only fully articulated 5-mm robotized instrument on the laparoscopy market;
• JAIMY is constantly evolving through cutting edge technology thanks to ENDOCONTROL’s close relationships with research laboratories and health facilities.

JAIMY makes surgery EASIER

JAIMY makes it easier – and sometimes even possible – to perform complex operating procedures.
• Fully articulated, JAIMY provides easier access to areas difficult to access in the abdominal cavity;
• Its motorization combines finesse and power while controlling the needle to penetrate semi-rigid tissues more easily;
• It helps young surgeons learn complex laparoscopic procedures;
• Single port approach becomes a reality.

JAIMY is VERSATILE

JAIMY meets all needs.
• Thanks to JAIMY, surgeons remain close to their patients in the sterile field;
• Its symmetrical design accommodates both right-handed and left-handed operators;
• It has a wide range of clinical applications: gynecology, bariatrics and general surgery.

JAIMY is ERGONOMIC

JAIMY improves the surgeon’s postural comfort significantly during the procedure.
• Ipsilateral surgical approach is possible for some procedures thanks to improved triangulation;
• Surgeon fatigue is decreased during surgery (decreased shoulder abduction and limited wrist movements).

JAIMY is INTUITIVE

20 seconds are enough to become familiar with all JAIMY’s features.
• Only one hand is necessary to operate JAIMY;
• Just one finger resting inside the ring on the joystick controls both JAIMY’s operating speed and movements;
• Haptic feedback is excellent;
• A ten-minute training session is enough for optimal use of JAIMY.

JAIMY is autoclavable and therefore meets the economic constraints of health facilities. Moreover, JAIMY is the least expensive robotics solution available on the market, as it doesn’t require any investment in capital equipment.
“Minimally invasive surgery offers many benefits for the patients but it also creates new challenges for the surgeons: lack of palpation, axial limitation of instruments, need to learn opposite movements, and use of long instruments through small incisions sometimes make the procedure much more difficult, particularly for suturing. The combination of JAIMY’s shaft distal flexion and jaw rotation makes suturing easier, and even possible in some cases, without the help of a telemanipulation robot, and improves the surgeon’s posture by reducing shoulder abduction.”

Pr. Brice Gayet, Digestive and HPB Surgery
Institut Mutualiste Montsouris (Paris, France)

“Minimally invasive surgery offers many benefits for the patient but it also creates new challenges for the surgeons...”

“JAIMY opens up a new world of possibilities in MIS (Minimally Invasive Surgery). Its hybrid robotics concept will dramatically broaden the applications of surgical robotics. It combines the precision and intra-abdominal degrees of freedom of traditional robotics with the flexibility and adaptability of the human hand.”

Dr. David Klifa, Urology Surgery
Clinique Saint George (Nice, France)
The global market of surgical robots is currently estimated at $3.2 billion and is expected to reach close to $20 billion in 2019 (Source: WinterGreen Research). With its numerous innovations, ENDOCONTROL is ideally positioned to play a major role in this high-growth market.

3.1 Global Innovation Competition 2014 award winner with the ARCC project

The project on robotic comanipulation for surgery ARCC (Assistance Robotique de Co-manipulation pour la Chirurgie), based on intelligent robot-surgeon interaction, was selected in 2014 by the Innovation 2030 commission chaired by Anne Lauvergeon for the Global Innovation Competition, in the category of Individualised Medicine.

The winners of this international competition were invited by the President of France François Hollande at the Elysée Palace in July 2014.

“I feel very honoured to have been invited today by the President of France, to celebrate the Global Innovation Competition. The announcement of our selection strengthens our credibility and positioning on the market of robotic surgery” said Clément Vidal.

“This award is also an international recognition of the innovative and promising nature of the technologies we are developing. Our ambition is to contribute to the development of medical robotics in France, and the fundamentals of this competition are in-line with our own vision, which is to develop products based on technological breakthroughs.”

The Global Innovation Competition is part of the “Innovation 2030” initiative, launched by the French State in 2013 to bring out talents and future champions of the French economy. Less than 10% of the projects presented were selected, and ENDOCONTROL’s ARCC project was one of them. The selected projects received funding of up to €200,000 from Bpifrance.

Further information of the Global Innovation Competition

On 18 April 2013, the President of France set up the Innovation Commission 2030, chaired by Anne Lauvergeon, who recognised the world’s main challenges for 2030 and identified a small number of high-potential opportunities to boost the French economy. This led to the selection of 7 projects targeting growth sectors for which there were high unmet demands.

The French State created the Global Innovation Competition to identify talents and future champions of the French economy, and to support French or foreign entrepreneurs whose innovation projects were potentially interesting for the French economy.

3.2 National Collaborative Robotics Competition 2015 award winner

Organized by the French Directorate General for Enterprise in partnership with CEA LIST, the creation of competitions targeting robotics close to the market is designed to identify and make known actors providing the best robotic solutions for promising applications. These competitions are also designed to bring together those offering innovative robotic solutions, large companies who use these products and investors.

The theme chosen for this first competition collaborative - robotics in the professional field - is an emerging but major trend in robotics, designed to improve business competitiveness, reduce arduous work, and find more effective solutions to societal challenges (health, autonomy, mobility, etc.).
The financial partners of ENDOCONTROL are French investment funds.

Two funds came in at the first funding round in 2007:
- CM-CIC Innovation is an affiliate of CM-CIC Investissement, and as its name suggests, its mission is to invest in innovative companies, out of its own resources.
- Sudinnova is also an affiliate of CM-CIC Investissement.

Two other investors came later:
- Seventure Partners, with over €500m under management is also one of the leaders in European venture capital. They joined the first two investors in 2010 during a second round of funding which raised €3m.
- Created in Marseille in 2000 under the name of Viveris Management, the company has funded so far, with minority stakes, close to 300 SMEs located in metropolitan France and overseas territories, and in the Mediterranean basin. To date, the company totals over €740m from its private investors.

These four investors participated in the €4m fundraising round closed on 6 December 2013.

ENDOCONTROL is present at the industry’s key events

In addition to these two awards, ENDOCONTROL is present at several international events, such as the Innorobo Congress (July 2015, Lyon), the ESGE Congress in Budapest, AFU in Paris, AAGL in Las Vegas, and MEDICA (November 2015, Düsseldorf). ENDOCONTROL is also very involved in the economic development of its region: the company participated in the 10-year anniversary of the high-tech cluster MINALOGIC, and in the Innovation Days organised by CCI Grenoble.

3.3 Active partners

The University Pierre et Marie Curie – ISIR (Institut des Systèmes Intelligents et de Robotique), ENDOCONTROL, Institut Mutualiste Montsouris and HAPTION, received the Prix de l’Intégration, for a scenario using products and technologies currently on the market, for Achille (laparoscopic surgery assistant), VIKY EP (motorized endoscope positioner) and JAIMY (robotic instrument for laparoscopy).

The objective of industrial cobotics is first and foremost to find solutions for difficult or arduous tasks, or tasks with very little added value from the operator. Cobots assist operators by enhancing their capabilities in terms of effort to manipulate safely parts that are either hot, heavy, bulky, or on the contrary too small for precise handling. Furthermore, cobots are able to adapt to the characteristics of the user.

Cobots are also used for issues of health and safety at work to improve ergonomics and prevent MSDs (musculoskeletal disorders). ENDOCONTROL and its partners transposed this innovative robotic concept to the operating room. The new generation robotics platform proposed by ENDOCONTROL has retained the advantages of conventional surgical robotics whilst overcoming its main disadvantages, i.e. the bulk and weight of robotic arms, the price, and the loss of contact between the surgeon and the patient.

One of the main advantages of this new platform is that surgeons remain in the operating field close to their patient throughout the procedure, which means they are able to act quickly in the event of a complication. The system is designed to assist surgeons not to replace them.

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