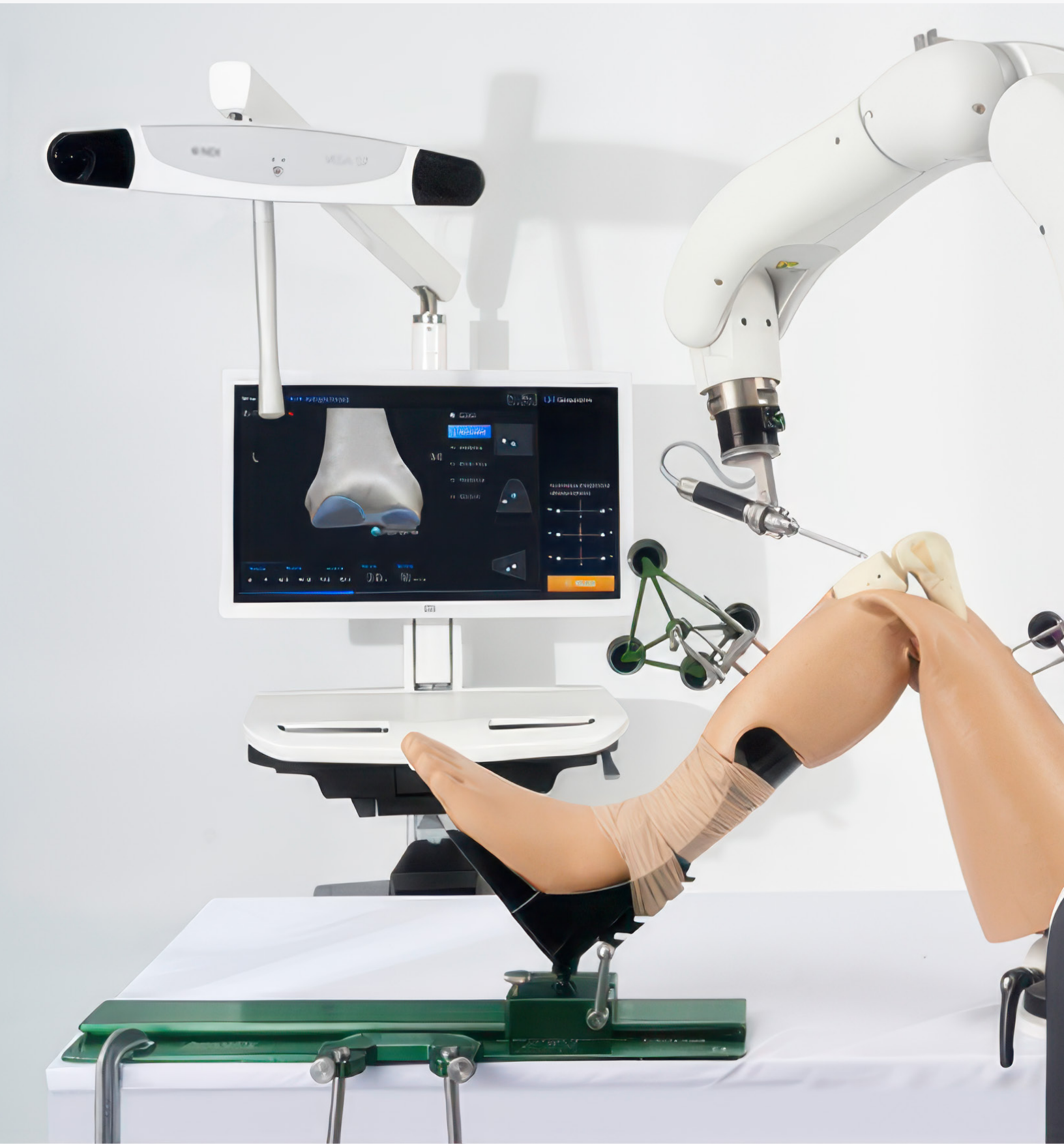




# Unlocking Orthopaedic Innovation

How CUREXO's Fully Autonomous CUVIS-joint Robot is Revolutionizing Joint Surgery

Case Study Prepared By:  
Northern Digital Inc. (NDI)



## The Revolutionary CUVIS-Joint Autonomous Robot by CUREXO

CUREXO has brought the world's first fully autonomous orthopaedic joint arthroplasty robot to life, the CUVIS-joint. Discover how this robotic innovation with integrated navigation from NDI is redefining joint surgery.

As the global population ages, the demand for arthroplasty, the surgical reconstruction or replacement of joints, has surged. CUREXO, a key player in the orthopaedic domain, envisions a future where medical technology goes beyond mere treatment, and aspires to create a healthier tomorrow with the help of their medical solutions. CUREXO's commitment to excellence is exemplified by their flagship product, the CUVIS-joint Surgical Robot. The CUVIS-joint is the world's first **fully autonomous artificial joint surgery robot**. It has been installed in 100 hospitals around the world and used in over 15,000 procedures as of 2023.

## Overcoming Joint Surgery Challenges with the CUVIS-joint

Joint surgery demands precision, accuracy, and personalized planning. Yet, surgeons continue to grapple with the intricacies of pre-planning, selecting, and inserting artificial joints, limb alignment, restrictions around implant options, and ensuring precise cuts, all of which can contribute to the longevity and durability of implants and optimal patient outcomes and patient satisfaction.

In recognizing the challenges of joint surgery, CUREXO developed the CUVIS-joint Surgical Robot. **The robot can accomplish autonomous cutting based on a sophisticated optical navigation system powered by NDI's Polaris Vega® ST and NDI's Passive Spheres® markers.**



## The CUREXO-NDI Partnership

CUREXO partnered with NDI for their optical navigation products and integration expertise. NDI is the industry leader in optical navigation products, with over 40 years of innovation in this space.

The partnership was driven by key factors, including NDI's proven system reliability, demonstrated product performance, longstanding, and successful presence in the MedTech market, cost-effectiveness, an expert integration team, seamless integration, and ease of use. These were critical considerations for CUREXO, leading to the partnership and setting them on the path to developing the world's first fully autonomous artificial joint surgery robot.

As CUREXO embarked into the development of the CUVIS-joint Surgical System, two critical technical challenges emerged related to navigation. They recognized the need to:

- **Integrate a precise navigation system into their surgical system.**
- **Minimize IR interference** in environments with infrared (IR) light sources.

The CUVIS-joint Surgical Robot seamlessly integrates the Polaris Vega® ST optical navigation system. Leveraging the precision of the Polaris Vega ST camera and its built-in software/API, the system can effectively identify sources of IR interference, issuing warnings to users. These advanced features not only enhance IR interference resistance, but also contribute to more stable tool tracking in the surgical environment in the presence of IR light.

The integration of the Polaris Vega ST optical navigation system into the CUVIS-joint ensures precision navigation during bone cutting, consequently ensuring an accurate implant placement. The Polaris Vega ST effectively addresses both of CUREXO's critical technical concerns, providing the needed solutions for CUVIS-joint's system functionality.

## The CUVIS-joint Surgical Robot – Precision Integrated with Planning for Enhanced Safety and Patient Outcomes

The CUVIS-joint Surgical Robot tackles the challenges faced by surgeons, providing a solution for personalized 3D pre-planning, accurate and precise cutting, plus the capacity for virtual surgery. Unlike most robotic solutions on the market, the CUVIS-joint is an **open platform, providing surgeons access to various implants**, allowing for freedom of choice, and added customization, contributing to more personalized joint surgeries.

The CUVIS-joint Surgical Robot system is made up of two main components.

1. The **main console**, which includes **NDI's Polaris Vega ST optical tracking camera**, and the system monitor which displays the surgical software.
2. The **robotic arm**, which includes the **operating software, a manipulator with six degrees of freedom designed for automatic cutting, and controls for the robot**, including a pendant with an emergency switch, and brake pedal.





NDI's Polaris Vega ST camera is affixed to the top of the main console on an articulating arm for easy repositioning. Two reference arrays, often called a patient reference, equipped with NDI's Passive Sphere markers, are affixed to the patient's femur and tibia. These patient arrays are critical for leg alignment measurements, joint angle calculations, and establishing a reference location against which the six degrees of freedom CUVIS-joint robot arm and end effector are tracked. Both the patient and the robot are tracked in real-time throughout the procedure using the Polaris Vega ST and the Passive Sphere markers.

**The combined high-performance measurement accuracy, high-speed tracking, and the rapid response rate of the Polaris Vega ST increases the CUVIS-joint's precision and safety in intra-OP plan changing and cutting.**



## Enhancing Arthroplasty Precision with the Navigated CUVIS-Joint Advantage

Every patient possesses anatomical differences in bone shape, leg alignment and range of motion. Because of this, a personalized approach provides the best outcomes when it comes to arthroplasty. The CUVIS-joint Surgical System enables surgeons to:

- **Visualize 3D images of the patient's bone** based on a **CT scan** taken during the pre-planning of surgery.
- **Register the patient anatomy.** Anatomical points on the femoral head and tibial plateau are captured using a handheld probe. NDI's optical camera continuously tracks the position of the probe, which is equipped with NDI Passive Sphere markers.
- **Guide customized selection of an artificial joint** based on a patient's leg alignment, joint capsule and the necessary angle and orientation of the implant.
- **Precisely cut as planned,** using the six-axis articulated robotic arm and integrated NDI navigation products. Boundaries for cutting are predetermined before milling begins. In the case that the cutting arm goes outside of this boundary, the cutting automatically stops.
- **Insert and precisely position the patient specific implant** with submillimeter accuracy. At this point, the joint capsule can be checked, and adjustments can be made within the procedure if needed.
- **Check pre and post limb alignments** with real time monitoring, assess medial and lateral gaps through the entire range of motion and visualize post operative flexion.



The heightened precision provided by CUVIS-joint and its integrated navigation has the potential to **enhance the longevity and durability of implants, leading to an optimal surgical outcome.**

With minimal equipment and human intervention, CUVIS-joint **mitigates the risk of infection and minimizes the possibility of human error.** This can result in **faster patient recovery and discharge from the hospital.** Additionally, for surgeons, the efficiency of the system can translate to providing more patients with arthroplasty while reducing bodily fatigue due to the fully autonomous functionality of the CUVIS Joint.

## Seamless Integration – The NDI Experience

The integration of NDI's navigation products into the CUVIS-joint Surgical Robot was instrumental in enhancing the overall solution. CUREXO attested to the **flawless performance** of the Polaris Vega ST, emphasizing its ease of use and **unwavering reliability.** The Polaris Vega ST delivered seamless performance, mirroring the dependability CUREXO experienced in their business communications with NDI. Timely product delivery further underscored the **reliability of NDI's services.** Additionally, CUREXO found the NDI navigation solution to be **cost-effective,** adding another layer of value to their experience.





*We are demonstrating that integrating active robotics with the NDI tracking system in surgical solutions can provide an extraordinary experience for both users and patients. I appreciate NDI's reliable quality system and proactive support for our R&D, and sales activities. Additionally, I look forward to achieving even more advanced technology that is better suited for our robotics through mutual efforts in the future."*

**Jun Lee**  
CEO of Curexo, Inc.



*Overall, we're very satisfied with our business interactions and NDI's product and business reliability."*

**HJ Kim**  
Senior Purchasing Manager



*We're confident in our partnership. NDI has been around for a long time in relation to medical navigation and we are well established to have stable product performance."*

**KH Lee**  
Sales Director

**CUREXO and NDI are proud partners, dedicated to advancing joint surgery, ultimately bringing better treatment and value to patients for a healthier tomorrow.**

Curious to learn more about NDI's Optical Products? Visit us today at [ndigital.com](https://ndigital.com).

## About CUREXO

Established in 2006, CUREXO has consistently risen to the forefront in the medical industry through relentless research and development. With a history marked by significant milestones in orthopaedics, the company, headquartered in Seoul, Republic of Korea, has become synonymous with groundbreaking advancements in orthopaedic surgery. CUREXO's dedication to innovation led to the development of the world's first fully automatic surgical robot, showcasing their commitment to pushing the boundaries of medical technology.

## About NDI

NDI is a global authority in optical and electromagnetic (EM) navigation products for the medical device market. Backed by over 40 years of industry expertise with a focus on innovation, our solutions are tailored to address the distinct navigation requirements of our clients — including the most challenging navigation needs. Renowned for our reliable systems, high-performance navigation products, expert support and integration team and our enduring partnerships, NDI is the trusted partner to facilitate the realization of your tracking applications and industry breakthroughs.



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Printed in Canada JULY 2024 – P/N DOC-10013774 Rev001