

Boyd Corporation uses JARVICE™ and the Nimbix Cloud to accelerate design of OsteoCool™, a leading RF Ablation probe for treating painful bone tumors



“Medical probes differ tremendously from one manufacturer to another, and since we couldn’t get the actual probes themselves, we ran massive simulations to determine which ones work best and why. With over 40 million mesh elements per probe, each simulation would take days to run on my computer. With JARVICE and the Nimbix Cloud, I start a simulation running at night and it’s done the next morning. And with Nimbix Cloud I can run simulations for three or four projects at the same time. I can’t do that on my computer.”

Adriana Druma
Design Engineer,
Boyd Corporation, and
Contributor to the OsteoCool™ RF Ablation system

INTRODUCTION

Medtronic was designing a new probe for interventional radiologists to treat bone tumors. The OsteoCool™ probe is heated by RF energy, which is contained to the tip and used for localized tumor ablation. During treatment, the probe tip is inserted into the tumor and heat is applied to the tumor cells. Because of the intense heat at tip of the probe, the rest of the unit must be cooled internally by circulating water to avoid charring adjacent tissue.

The probe itself is small and minimally invasive, and the treatment lessens the pain of the tumor and improves the patient's quality of life. Due to the probe's size and the need to protect the surrounding tissue, there were precise requirements for cooling the unit. In addition, the probes themselves are very expensive and unavailable for physical testing and analysis, therefore electromagnetic simulations were required for all analyses.

To determine the probe design and cooling options that would provide optimal operation and patient care, Medtronic worked with Boyd Corporation and design engineer Adriana Druma to run simulations on many possible design configurations, each of which contained millions of data points. To run rapid, simultaneous simulations, accelerate the design and testing phases, and allow Medtronic to quickly bring the OsteoCool™ to market, Boyd needed the resources of an HPC partner like Nimbix.

CHALLENGES

The OsteoCool™ targets small areas of cancerous cells. The probe needed to get hot enough to ablate the cells in the tumor, while precisely controlling the spread of heat to the surrounding area. Any heat from the probe that goes beyond the bone tumor cells and into the surrounding tissue could cause damage and additional pain to the patient. This is especially critical in the case of tumors located in the vertebrae, as any extra heat could irreparably damage the spinal cord.

To ensure the safety of the device the Boyd team was faced with multiple design challenges. Due to the complex geometry of the probe, the large aspect ratio between length and thickness, the turbulence of fluid flowing through an extremely small tube at high speeds, and the very fine mesh count required—between 30 and 60 million elements—each simulation could take several

days to complete on the team's in-house computers. In addition, the team lacked sufficient local software licenses, which slowed the process even further. These factors meant that using the Boyd's existing computing infrastructure, the team would be hard-pressed to complete the design recommendations within the client's tight timeline.

TECHNOLOGY USED

The Boyd team used the Nimbix Cloud powered by JARVICE to perform the simulations needed, providing the speed of a supercomputer without the hardware cost of one. The Nimbix Cloud cut the processing time from days per simulation to mere hours, while also allowing the team to run multiple simulations for more than one project simultaneously. The Nimbix platform also allowed access to multiple licenses with one click, allowing expanding access to advanced software for analyzing, modeling, and simulating high frequency electromagnetic field data.

In addition, Nimbix provided comprehensive support to get Druma's team up and running on the Nimbix Cloud, including videos, training, documentation, and speedy live support to handle any issues they encountered during the project.

ENGINEERING SOLUTION

Using the Nimbix Cloud to run EM simulation software and analyses, the Boyd team identified the ideal design and cooling system for the OsteoCool™ probe. Boyd's accelerated work allowed Medtronic to design and build the optimal probe solution in only six months.

Since its introduction to the market in 2016, OsteoCool™ has:

- Treated more than 10,000 cases
- Received FDA approval to treat painful benign (Osteoid Osteoma) tumors
- Expanded treatments to include peripheral bones to the existing spinal indications
- Become the industry standard for RF-related treatment of bone tumors

BENEFITS

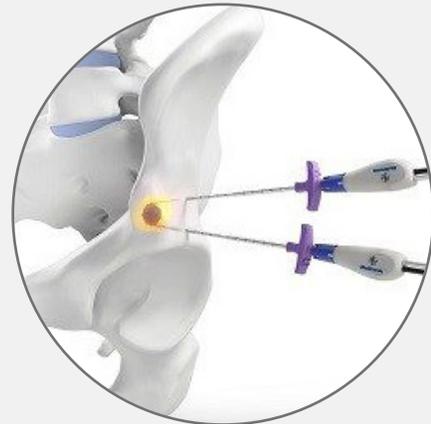
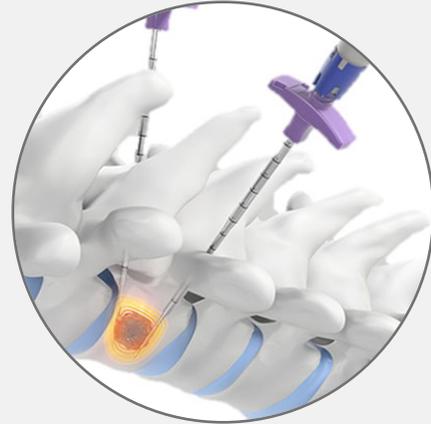
The engineers at Boyd work closely with their clients and various manufacturing teams to provide streamlined products through their efficient design process—from concept to prototyping to production. JARVICE and the Nimbix Cloud enables them to run EM simulations in a matter of hours—instead of days—further accelerating Boyd’s design capabilities and their clients’ ability to bring products to market faster.

Thanks to Boyd’s analyses and designs for Medtronic, the OsteoCool™ RF Ablation system now provides interventional radiologists a better option to treat patients and improve their quality of life.

“With Nimbix, I don’t just interact with a computer, there’s actual human support,” says Druma. “They understand how important this is and customized our software to run our simulations. Now I can see my simulations running in real time, instead of waiting until it’s done. The whole system is interactive and very easy to use.”

COMPANY DESCRIPTION

Boyd Corporation is a global pioneer in integrated sealing, thermal management, and protection solutions that enable its customers’ technologies to change the world. Its designs make space exploration safer and more attainable, medical care more accurate and accessible, and electronics smarter and better connected. Its goal is to develop solutions that move technology forward by making its clients products faster, safer, lighter, more reliable, and longer lasting. From self-driving cars to remote medical diagnostics, hyperscale computing to scalable power conversion of renewable sources, as its customers redefine their industries, integrated solutions from Boyd make their futures possible.



The OsteoCool™ RF Ablation system is a minimally-invasive tool used to treat bone tumors without damaging the surrounding tissue.