Hoth Intelligence: Competitive Analysis

Introduction

Virtual reality (VR) and augmented reality (AR) are revolutionizing the healthcare technology market. While VR technology has proved popular in some niches, like surgical planning, training simulations, and digital therapeutics, the cost and practical limitations of VR technology have restricted widespread adoption.

Conversely, AR technology, which allows users to interact with their surroundings while incorporating digital information, has been gaining steady traction. In surgical theatres, AR technology superimposes digital imaging models over the patient's anatomy, enabling surgeons to visualize and navigate complex anatomical features in real time without losing sight of the surgical incision area. Given the decreasing cost of AR hardware and new, use case opportunities, AR for healthcare applications is expected to grow at a 13% CAGR, reaching $76 billion by 2030.

Hoth Intelligence

Hoth Intelligence develops software solutions used in conjunction with AR devices to improve healthcare for patients and achieve better surgical outcomes. In its first chapter, Hoth Intelligence will address bedside surgical procedures currently performed without imaging guidance, which tend to have high error rates and result in patient complications. Specifically, the company is targeting external ventricular drain (EVD) placement, a procedure with 45% and 18% error and revision rates, respectively.

Hoth Intelligence's AR software solution creates a 3D reconstruction using the patient's conventional scans, like CT and MRI imaging, and uploads the reconstruction into a ThirdEye Gen or Microsoft HoloLens headset. Using the company's proprietary snap-to facial recognition technology, the surgeon can visualize the patient-specific reconstruction as a real-time overlay during the procedure. This technological improvement should lead to better EVD placement and reduce error and revision rates.

- **Overlay:** Yes
- **Fiducial Marker:** No; uses snap-to facial recognition.
- **Mobility:** Bedside procedure; ability to expand use cases (ENT, plastics, EM, etc.)
- **Versatility:** Neuro
- **Size:** 1.2 lb. headset (Microsoft HoloLens 2)
- **Hand Tracking:** Yes
- **Price:** 120k annual, post-FDA; 50k annual educational.
- **FDA Clearance:** end of 2022.

Competition

There are several companies providing AR- and VR-based products and solutions as well as other imaging solutions for surgical planning and procedures. While these companies focus on operating room procedures, Hoth Intelligence is the only company addressing the bedside surgical procedure use case from a commercial standpoint.

Potential competitors in this space fall into three categories: (1) AR / VR solutions overlaying patient anatomy, (2) AR / VR solutions without overlay, (3) Other solutions.

(1) AR / VR solutions overlaying patient anatomy

Medtronic & Surgical Theater Partnership: *StealthStation S8 + SyncAR*

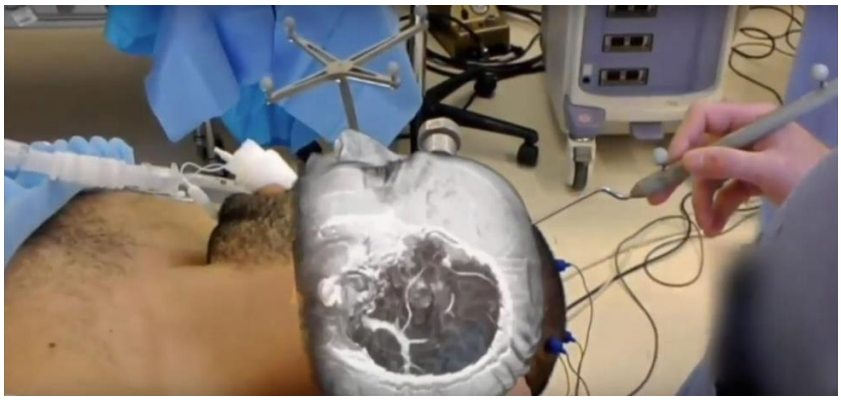
Medtronic partnered with Surgical Theater to offer an AR platform for cranial procedures. This platform integrates Medtronic's **StealthStation S8** surgical navigation system with Surgical Theater's **SyncAR** technology. StealthStation S8 is designed to track surgical instruments and guide the user during procedures through hardware and software with tracking and image dataset merging algorithms. SyncAR is designed to allow surgeons to visualize brain structures, test virtual surgical tools and plan surgeries before entering the operating room through simulation technology.

- **Overlay:** Yes, if used in conjunction with exoscope
- **Fiducial Marker:** Yes; two surgistations, manual alignment, and wand; >30 min setup
- **Mobility:** OR; planning and intraoperative procedures
- **Versatility:** Neuro, Cardio, etc.
- **Size:** Large surgical navigation system, large AR visualization hub, large exoscope; extremely difficult to take out of OR
- **Hand Tracking:** No
- **Price:** >$2mn = $660k StealthStation S8, >$500k SyncAR (estimate), $800k exoscope
- **FDA Clearance:** Yes

Medivis: *SurgicalAR*

SurgicalAR integrates augmented reality, AI, and computer vision to advance surgical planning. Leveraging the Microsoft HoloLens 2.0 headset, Surgical AR enables physicians to visualize patient imaging holographically, allowing for greater precision and real-time decision making in prior to the procedure and inside the operating room.

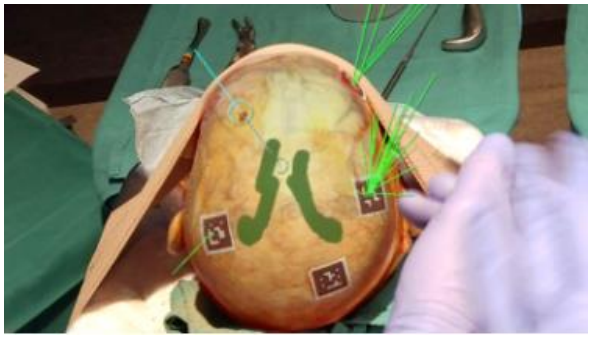
- **Overlay:** Yes
- **Fiducial Marker:** Quick-response QR code.
- **Mobility:** OR; neuro or spinal surgical procedures
- **Versatility:** Neuro, Ortho
- **Size:** 1.2 lb. untethered headset (Microsoft HoloLens)
- **Hand Tracking:** No
- **Price:** Unknown
- **FDA Clearance:** Yes



Novarad: *OpenSight* and *VisAR*

VisAR is the successor to Novarad's FDA-approved OpenSight product. VisAR renders 2D, 3D, and 4D digital images from any modality into a detailed hologram in real-time using the Novarad Graphics Engine. The hologram is overlaid directly onto a patient's body using patented virtual tool technology with an integrated targeting system. VisAR maps both the patient and the surrounding environment using optical code alignment, cameras, and sensors. Leveraging the hands-free, untethered Microsoft HoloLens 2.0 headset, VisAR allows surgeons to colorize target organs, overlay virtual annotations for incisions, define pathology and anatomy, and create virtual needle or instrument insertions.

- **Overlay:** Yes
- **Fiducial Marker:** Superficial image marker
- **Mobility:** Pre-operative localization and planning of surgical options; not intended for intraoperative use or stereotactic procedures
- **Versatility:** Neuro, Ortho, Interventional Radiology
- **Size:** 1.2 lb. untethered headset (Microsoft HoloLens)
- **Hand Tracking:** No
- **Price:** $60k - $300k set up cost, $5k monthly fee
- **FDA Clearance:** Yes

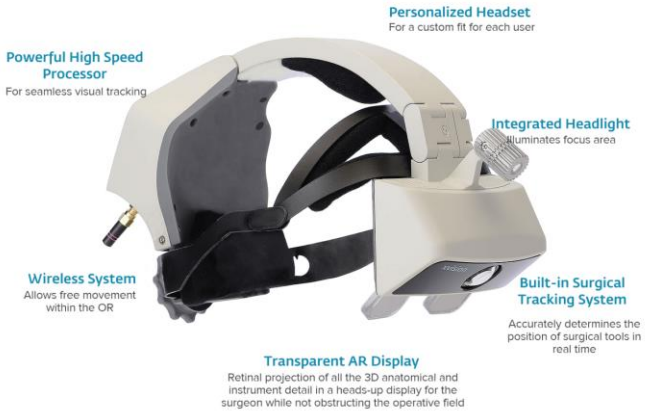


(2) AR / VR solutions without overlay

Augmedics: *xvision Spine system (XVS)*

xvision Spine system (XVS) consists of a proprietary, transparent near-eye-display headset incorporating the elements of a traditional navigation system. XVS allows surgeons to visualize patients' 3D spinal anatomy during surgery helping them to accurately navigate instruments and implants while looking at the patient, rather than a physical screen. The system determines the position of surgical tools in real-time and superimposes it on patient CT data, allowing the surgeon to perform surgery while viewing a virtual navigation screen through the headset.

- **Overlay:** No overlay; visualization on virtual screen
- **Fiducial Marker:** Patient Clamp attached to spinous process or Perc Pin inserted into PSIS
- **Mobility:** OR; spinal and pelvic surgical procedures
- **Versatility:** Neuro & Ortho
- **Size:** 3 lb. untethered headset (also made by Augmedics)
- **Hand Tracking:** No
- **Price:** $500k
- **FDA Clearance:** Yes



ImmersiveTouch: *ImmersiveView Surgical Plan*

ImmersiveView Surgical Plan is a platform that generates high-fidelity 3D VR replicas from patient DICOM scan data and provides a variety of tools for use directly on the model in VR. This allows surgeons to study, assess, and plan their surgeries, collaborate intra-operatively with their surgical team and better educate patients about their upcoming surgery.

- **Overlay:** No overlay; virtual reality
- **Fiducial Marker:** No marker
- **Mobility:** Training tool
- **Versatility:** CMF, Neuro, ENT, Cardiothoracic
- **Size:** 1.1 lb. headset (Oculus Rift VR)
- **Hand Tracking:** No
- **Price:** >$500k (estimate)
- **FDA Clearance:** Yes

SentiAR: *CommandEP*

CommandEP uses real-time data from catheter and 3D electroanatomic mapping systems to recreate an anatomical and electrical map of the patient's heart. Displaying the inner heart surface geometry allows physicians to understand exactly what's happening during procedures and afterward and easily explain to patients how the procedure went by showing them in 3D. CommandEP comes with a visual interface, allowing the surgeon to control their display without unnecessary touching, essential for maintaining sterility in the OR.

- **Overlay:** No overlay; visualization in space
- **Fiducial Marker:** No marker
- **Mobility:** OR; adjunct visualization tool for cardiac catheter mapping and ablation procedures
- **Versatility:** Cardio
- **Size:** 1.2 lb. untethered headset (Microsoft HoloLens)
- **Hand Tracking:** No
- **Price:** >$500k (estimate)
- **FDA Clearance:** Yes

(3) Other Solutions

7D Surgical: *Flash Navigation*

7D Surgical's **Flash Navigation Platform** provides a radiation-free image guided navigation solution for surgeons. Their equipment reduces the need for and reliance on intraoperative radiology equipment and support staff during surgery. It also reduces registration time from 30 minutes to less than 30 seconds and enables re-registration in less than 10 seconds to confirm and maintain accuracy. The overhead light features machine-vision cameras that provide 3D image guidance with nearly 1 million data points for informed decision making.

- **Overlay:** No
- **Fiducial Marker:** Yes
- **Mobility:** OR; maneuverable around hospital
- **Versatility:** Neuro and spinal
- **Size:** No headset
- **Hand Tracking:** No
- **Price:** $500k
- **FDA Clearance:** Yes

Alcon: *Ngenuity 3D Visualization System*

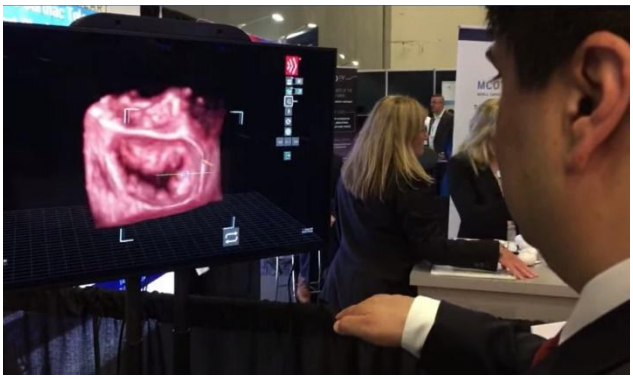
Ngenuity 3D Visualization System integrates with all analog microscopes for more informed decision making. The integrated system delivers a real-time view of surgical parameters and system performance for more information during critical surgical steps while allowing surgical staff and residents to see with the same depth, clarity, and focus as the surgeon. Two cameras affixed to an operating microscope send signals to a central processor, which transmits an image onto a wide-screen high-definition monitor. Surgeons wear polarized glasses to appreciate the three-dimensionality of the image on a 2-D surface.

- **Overlay:** Yes
- **Fiducial Marker:** No
- **Mobility:** OR; intraoperative
- **Versatility:** Ophthalmology
- **Size:** No headset
- **Hand Tracking:** No
- **Price:** >$100k (estimate)
- **FDA Clearance:** Yes

EchoPixel: *Holographic Therapy Guidance (HTG)*

Holographic Therapy Guidance (HTG) software platform provides a 4D holographic experience of live 4D ultrasound images including refence of pre-op CT and MRI images. It allows the physician to have enhanced awareness of catheters and tools relative to a patient's anatomy as well as review the planning images throughout a procedure. The proceduralist controls the digital twin and can turn it, view cross sections and see the valves open and close as the actual heart beats, saving time and improving accuracy.

- **Overlay:** No overlay; visualization on screen
- **Fiducial Marker:** No
- **Mobility:** OR, Cath Lab; congenital heart defect and structural heart procedures
- **Versatility:** Cardio
- **Size:** No headset
- **Hand Tracking:** No
- **Price:** >$100k (estimate)
- **FDA Clearance:** Yes



Zeta Surgical: Navigation and Robotics Platform

Zeta's Navigation and Robotics platform leverages computer vision and AI to enable surgeons to operate at the point-of-care on fully awake patients. The company is first focusing on procedures performed outside of the OR like ventriculostomy and neuromodulations. The system includes a mixed reality overlay designed to help surgeons pinpoint minimally invasive neurosurgery procedures. It can be combined with an optional robotic system that utilizes an off-the-shelf Doosan robotic arm combined with proprietary tools.

- **Overlay:** No overlay; visualization on screen
- **Fiducial Marker:** No
- **Mobility:** Bedside procedure
- **Versatility:** Neuro
- **Size:** No headset
- **Hand Tracking:** No
- **Price:** NA
- **FDA Clearance:** No

Ultrasound Device

- **Overlay:** No
- **Fiducial Marker:** No
- **Mobility:** Broad range
- **Versatility:** Non-Neuro
- **Size:** Can be handheld
- **Hand Tracking:** No
- **Price:** $75k
- **FDA Clearance:** Yes

Company Profiles

Medtronic

One of the largest medical device companies, Medtronic develops and manufactures therapeutic medical devices for chronic diseases. Its portfolio includes pacemakers, defibrillators, heart valves, stents, insulin pumps, spinal fixation devices, neurovascular products, advanced energy, and surgical tools. The company markets its products to healthcare institutions and physicians in the United States and overseas. Foreign sales account for almost 50% of the company's total sales.

- **Founded:** 1949
- **Ownership Status:** Publicly Held (NYS: MDT)
- **Funding / Valuation:** $156bn EV
- **Employees:** 90,000
- **Patents:** 10,530

Surgical Theater

Developer of a virtual reality visualization platform designed to offer an immersive environment for patients. The company's platform is a three-dimensional surgical theater system that integrates patient-specific surgical planning and navigation and creates an engaging experience by offering education and surgical collaboration, thereby enabling surgeons to perform a real-life flight simulation before the actual operation.

- **Founded:** 2010
- **Ownership Status:** Privately Held
- **Funding / Valuation:** $36mn raised to date
- **Funding Round:** Later Stage VC (2020)
- **Employees:** 72
- **Patents:** 13

Medivis

Provider of a medical imaging technology designed to utilize augmented reality for surgical operations. The company's technology leverages augmented reality and artificial intelligence to facilitate advanced medical imaging and holographic visualization, enabling physicians to overlay images directly onto the patient, permitting precise decision-making inside the operating room.

- **Founded:** 2016
- **Ownership Status:** Privately Held
- **Funding / Valuation:** $2.3mn raised to date
- **Funding Round:** Early-stage VC (2021)
- **Employees:** 11
- **Patents:** 3

Novarad

Developer of a healthcare enterprise imaging software designed to solve imaging problems. The company's software provides a complete patient record view and an entirely customizable workflow and manages healthcare facility's information by providing an efficient workflow for managing both DICOM and non-DICOM images throughout the hospital by transitioning the storage of images and patient information from hard drives, disks, disparate archives, and USB drives to a vendor neutral archive.

- **Founded:** 1990
- **Ownership Status:** Privately Held
- **Patents:** 11

Augmedics

Developer of an augmented-reality surgical visualization system designed to assist in viewing the patient's anatomy through skin and tissue during surgeries. The company's product includes a head-mounted display that uses augmented reality to see the patient's spine through skin and tissue while accurately determining the position of surgical tools in real-time and illuminating the focus area using integrated lights, enabling surgeons to gain insight and assistance while performing complex surgeries.

- **Founded:** 2014
- **Ownership Status:** Privately Held
- **Funding / Valuation:** $86mn post-money
- **Funding Round:** Later Stage VC, Series C (2021)
- **Employees:** 82
- **Patents:** 8

ImmersiveTouch

Developer of a virtual and augmented reality medical software designed to train nurses and new doctors through virtual reality simulators. The company's software offers surgical simulators that converts radiology scans into 3D simulations to provide surgical planning and anatomical exploration technologies, enabling medical trainers to train nurses and doctors easily.

- **Founded:** 2005
- **Ownership Status:** Privately Held
- **Funding / Valuation:** $1.6mn raised to date
- **Funding Round:** Angel (2020)
- **Employees:** 30
- **Patents:** 3

SentiAR

Developer of a 3D augmented reality platform designed to transform the experience for both patients and clinicians in interventional procedures. The company's platform features real-time holographic visualization of the patient's actual anatomy and utilizes a hands-free, head-up display to change the way data and imaging results are displayed in the operating room, enabling clinicians to treat and analyze cardiac arrhythmias within an interventional catheter lab environment.

- **Founded:** 2017
- **Ownership Status:** Privately Held
- **Funding / Valuation:** $13.7mn post-money
- **Funding Round:** Early Stage VC, Series A (2021)
- **Employees:** 17
- **Patents:** 5

7D Surgical

Developer of an image-guided surgery system designed to conduct radiation-free surgeries. The company's system leverages machine vision technology and has improved line of sight, precision, workflow, radiation exposure through complete sterile system control and improves conditions for surgeons, staff and patients, enabling the healthcare industry to undertake surgeries in a secure manner.

- **Founded:** 2009
- **Ownership Status:** Privately Held
- **Funding / Valuation:** $110mn (acquired by SeaSpine)
- **Employees:** 52
- **Patents:** 2

Alcon

Alcon, headquartered in Fort Worth, Texas, is the global eyecare leader with a diverse portfolio in ophthalmology including contact lenses, eye drops, surgical equipment, and related surgical products. Novartis purchased Alcon from Nestle in 2010 and, following nine years as a Novartis subsidiary, the company was spun-off as a public company in April 2019. The company reports five distinct segments: implantables (16% of revenue), consumables (31%), equipment (9%), contact lenses (27%), and ocular health (17%). The company is geographically diversified, with only about 40% of revenue from the U.S. market, and the firm has a strong presence in the European Union and Japan.

- **Founded:** 1945
- **Ownership Status:** Publicly Held (SWX: ALC)
- **Funding / Valuation:** $41bn EV
- **Employees:** 24,389
- **Patents:** 1,837

EchoPixel

Developer of a medical visualization technology designed to view and interact with patient tissues and organs in a three-dimensional form. The company's technology offers an intuitive, interactive virtual reality format to communicate with patient-specific organs and tissue in an open 3D space emanating from a display, enabling doctors and physicians to immediately identify, evaluate, dissect clinically significant structures and open virtual patient-specific anatomy.

- **Founded:** 2012
- **Ownership Status:** Privately Held
- **Funding / Valuation:** $21.3mn post-money
- **Funding Round:** Early Stage VC, Series A (2017)
- **Employees:** 11
- **Patents:** 10

Zeta Surgical

Developer of augmented reality tools designed to bring quality image guidance into a wider range of procedures. The company's tools help to overlay 3D anatomical images like ultrasound and CT scans inside patients while tracking and displaying positions of surgical instruments along with their blueprints for the procedure, enabling surgeons to operate surgeries effectively and safely.

- **Founded:** 2016
- **Ownership Status:** Privately Held
- **Funding / Valuation:** $7.0mn raised to date
- **Funding Round:** Seed round (2022)
- **Employees:** 9