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## What supports today's surgery?

**Dedicated surgical imaging.**

Answers for life.

**SIEMENS**



Whatever your surgical imaging needs, Siemens covers them. With one of the broadest portfolios of dedicated X-ray and ultrasound systems on the market today, Siemens is a leader in intra-operative imaging for most surgical disciplines.

Whether a flexible mobile C-arm, compact ultrasound system or fixed C-arm in a hybrid operating room, Siemens has an appropriate system for imaging needs during surgery.

Think intraoperative imaging.  
Think Siemens.



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“Reliably evaluating small vessel anastomoses is crucial for our procedures.”



## The rapidly changing field of cardiovascular surgery

Clearly, the future of cardiovascular surgery is minimally invasive. With the introduction of drug-eluting stents, hybrid revascularization with a MIDCAB (minimally invasive direct coronary artery bypass) to the LAD (left anterior descending) artery and stenting of other vessels have become valid alternatives to conventional CABG (coronary artery bypass grafting).

Structural heart disease therapy has undergone revolutionary changes with the advent of catheter-based techniques for congenital heart and heart valve disease. Endovascular therapy has become the treatment of choice for the aorta and peripheral arteries in some indications. All of these new surgical therapies require highly advanced imaging systems to perform them.

**Think intraoperative imaging.  
Think Siemens.**

# Dedicated imaging for cardiovascular surgery

Cardiovascular surgery covers a wide array of procedures and methods, each with specific imaging requirements. The following overview is designed to provide assistance in selecting the most suitable imaging modality.

## Quantitative coronary angiography

Assessing coronary artery stenoses for hybrid revascularization or quantifying stenoses in bypass grafts usually requires a **fixed C-arm** system.



## Valve disease

**Echo** and **fixed C-arm** systems are complementary imaging modalities in catheter valve therapies for adults. In individual cases, a high-powered **mobile C-arm** may be considered as an alternative to a **fixed C-arm**.



## Percutaneous coronary interventions (PCI)

A **fixed C-arm** system is recommended for PCI, particularly for longer procedures and high-volume centers.



## Heart rhythm surgery

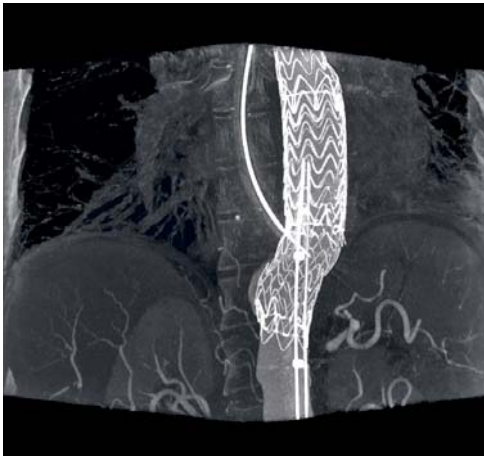
Electrophysiology and arrhythmia surgery are currently joining forces in complementary epi- and endocardial methods. Mapping systems, including navigation, are available only with **fixed C-arms**.



## Congenital heart disease

Treatment of structural heart disease in children using imaging systems requires a high temporal resolution, which is best provided by **ultrasound** and dedicated **fixed C-arm** systems with very high frame rates.

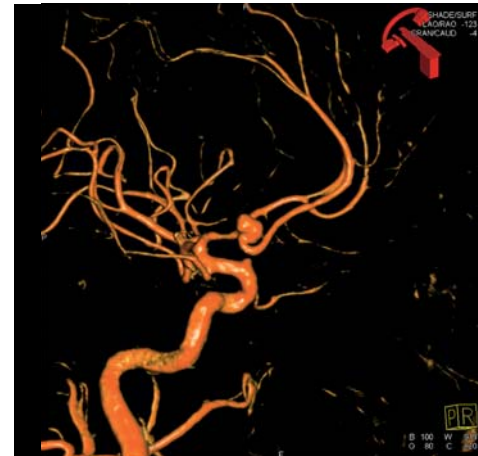




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### Endovascular aortic repair (EVAR)

Powerful **mobile C-arms** are currently used for EVAR and are sufficient in most cases. For complex cases and lengthier procedures, a **fixed C-arm** can offer added security with advanced imaging functions like 3D imaging and overlay. **Intra-arterial ultrasound (ICE)** can provide complementary information on blood flow and soft tissue anatomy.



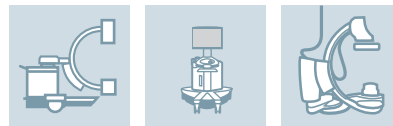
### Pacemakers/defibrillator implants

Conventional one- or two-chamber pacemakers and defibrillators are commonly implanted using a **mobile C-arm** with excellent image quality. In certain cases, involving biventricular pacemakers or defibrillator implants, steep angulations or an overlay of a venogram during fluoroscopy may be helpful. This would require a **fixed C-arm** system. **Echo** systems can provide additional functional information, particularly in CRT.



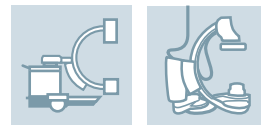
### Carotid artery stenting/peripheral vessels

The carotid artery and peripheral vessels are ideally evaluated by **ultrasound with Doppler** and a **mobile C-arm**. A **fixed C-arm** system may offer additional information such as perfusion and/or vessel quantification.



### Placement of intravascular catheters

For placement control of pulmonary artery catheters, central venous catheters or IABPs, a **mobile C-arm** is a convenient system given its versatility. A **fixed C-arm** can also be used if additional performance is needed.



#### System icon overview

The system icons appear from left to right in order of the Siemens system recommendation for the respective application.



Mobile C-arm system



Fixed C-arm system



Ultrasound system

## The novel ways of neurosurgery

Advanced imaging and navigation capabilities that enable integrated interventions play a key role in today's neurosurgery. Planning and performing stereotactic procedures with the help of intraoperative 3D imaging, for example, is an increasingly popular practice.

Likewise, stenting intra- and extracranial vessels has become an important adjunct to surgery. The treatment of intracerebral aneurysms has been further improved through the use of flexible endovascular and open surgical approaches. Highly advanced imaging systems make it possible.

**Think intraoperative imaging.  
Think Siemens.**



“Imaging systems that support interventional aneurysm treatment are the future.”



## Dedicated imaging for neurosurgery

Similar to cardiovascular surgery, neurosurgery comprises a variety of new techniques and procedures with very specific imaging requirements. The following overview is designed to provide assistance in selecting the most suitable imaging modality.

### Aneurysm clipping and coiling

If coiling of aneurysms is performed, a **fixed**, preferably a **biplane C-arm** system, is recommended. Clipping of aneurysms can also be done with a **mobile C-arm**.



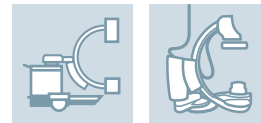
### Stereotactic surgery

Fluoroscopic guidance for frameless stereotactic procedures is supported by both **mobile** and **fixed C-arm** systems with integrated 3D capabilities. Advanced imaging with live overlay of 3D structures is provided only by **fixed C-arm** systems.



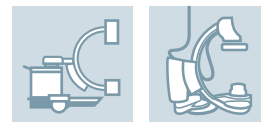
### Spine surgery

Main applications in spine surgery include fusion of vertebrae, kyphoplasty and vertebroplasty. **C-arms** with high resolution and penetration are essential to monitor correct positioning of screws, instruments, implants and injected cement. Optional 3D imaging with navigation may enhance treatment precision and enable intraoperative evaluation of the surgical procedure.



### Pain management

Interventional procedures typically used for chronic back pain such as epidural steroid injections, facet joint injections and neurolytic blocks are controlled under successive fluoroscopy. Great flexibility of projections along with easy self-controlled handling are essential system features.





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### Arteriovenous malformation surgery

Surgery for AV malformations with coiling of the arterial supply requires a **fixed C-arm** system. A **biplane C-arm** system is recommended for these complex procedures.



### Carotid artery stenting

The carotid artery and peripheral vessels are ideally evaluated with **Doppler ultrasound** and a **mobile C-arm**. A **fixed C-arm** system can provide additional information, for example, perfusion and vessel quantification.



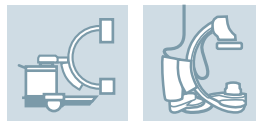
### Tumor surgery

Integrating MR functional imaging and combining it with navigation in the OR is a state-of-the-art solution for brain tumor surgery. Combining MR imaging with a **fixed C-arm** may take you to the next level.



### Shunt surgery

To evaluate the correct placement of the shunt in a central vein, a **mobile C-arm** is sufficient. However, to locate the shunt within the lateral ventricle, 3D imaging with soft tissue contrast, in other words a **fixed C-arm**, is necessary.



#### System icon overview

The system icons appear from left to right in order of the Siemens system recommendation for the respective application.



Mobile C-arm system



Fixed C-arm system



Ultrasound system



“We need real-time imaging for precise fracture identification and repositioning.”

## Operating with confident guidance

Minimally invasive procedures are also becoming more and more commonplace in orthopedic and trauma surgery. This is partly due to cost pressures and time constraints, but primarily in an effort to minimize tissue damage and improve patient recovery time.

Advanced imaging tools such as C-arms offer surgeons ideal support. The use of navigation in spine surgery can increase the precision of procedures while also saving time and dose. 3D imaging provides excellent support for delicate placement tasks, reduces the rate of second interventions, and has revolutionized the entire workflow.

**Think intraoperative imaging.  
Think Siemens.**

# Dedicated imaging for orthopedic and trauma surgery

For years, imaging technologies have played an essential role in orthopedic and trauma surgery. The following overview is designed to provide assistance in selecting the most suitable imaging modality.

## Fracture treatment

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During osteosynthesis of fractured bones, placement of screws, plates and nails is controlled under successive X-ray. Therefore, the positioning flexibility of a **mobile C-arm** is an important requirement. Optional 3D imaging with navigation may enhance precision of treatment as well as allow intraoperative evaluation of the surgical procedure.



## Extremities surgery

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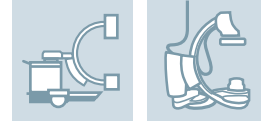
Surgery of fractured parts of the hand and foot requires high resolution of fine structures and zoom functionalities, as well as an easy-to-adjust, small system like a **mobile C-arm**.



## Pelvic surgery

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Surgery of a fractured pelvis can be a complex challenge. **Mobile C-arms** readily support bone repositioning and fixation. Intraoperative imaging of the whole pelvis in 3D requires a multi-axis **fixed C-arm** system with large volume imaging.



## Osteotomy

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Osteotomy is a surgical operation whereby a bone is cut to shorten, lengthen or change its alignment. Conventional 2D imaging with advanced measuring functionalities is suitable.

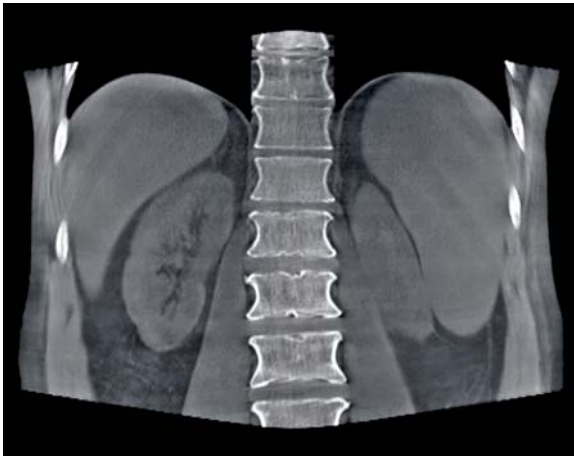


## Prosthesis

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In the growing field of artificial hip and knee prosthesis surgery, visualization is usually performed with conventional mobile 2D imaging. Available advanced penetration capabilities are advantageous in hip replacements for obese patients.

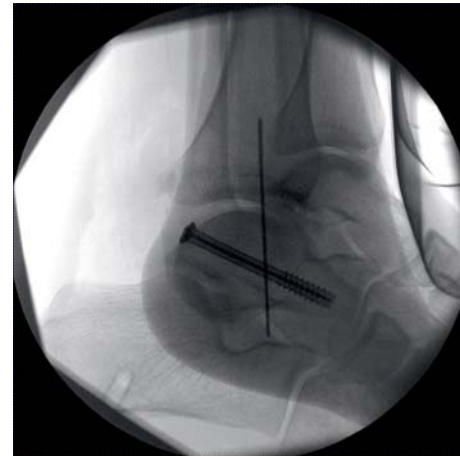




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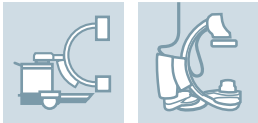
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## Spine surgery

Main applications in spine surgery include, fusion of vertebrae, kyphoplasty and vertebroplasty. **C-arms** with high resolution and penetration are essential to monitor correct positioning of screws, instruments, implants and injected cement. Optional 3D imaging with navigation may enhance treatment precision and enable intraoperative evaluation of the surgical procedure.



## Tumor surgery

Preoperative PET or PET/CT imaging and fusion with intraoperative CT-like bone imaging enables the surgeon to locate bone tumors in 3D on the intraoperatively acquired data. 3D acquisition and fusion software are required and are mainly being done with **fixed C-arms**. In individual cases, an advanced **mobile 3D C-arm** may be considered as an alternative.



### System icon overview

The system icons appear from left to right in order of the Siemens system recommendation for the respective application.



Mobile C-arm system



Fixed C-arm system



Ultrasound system

Please note that regional regulations may limit the systems choice.

“We reviewed various options before reaching a decision.”



## Other essential system considerations

In addition to supported applications, a variety of other factors require consideration when selecting the appropriate surgical imaging system. Factors such as system mobility, power output, 3D and soft tissue imaging capabilities, but also room size and budget should not be overlooked.

### Room size

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Space constraints pose a special challenge for imaging systems during surgery. A **mobile C-arm** is suitable for almost any room size and can be moved at will from one OR to the next. A **fixed C-arm** system, on the other hand, requires a minimum room size of 45 m<sup>2</sup> (484 ft<sup>2</sup>).

### Soft tissue imaging

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Soft tissue 3D imaging to detect tumors or bleedings is possible with a **fixed C-arm**. The information in these images is important for surgery planning and post-operative evaluation.

### Budget

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The most important rule of thumb for all healthcare providers regarding investments is that they must pay off. Siemens has a broad lineup of **fixed C-arm** systems, **mobile C-arms** and **ultrasound** systems to choose from for various budgets that offer great value performance.

### Mobility

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If room flexibility is one of your most important needs, a **mobile C-arm** is a solid choice. With its easy maneuverability, it can serve several ORs in the surgery department. An **ultrasound** system can provide additional information, and also requires very little space. A **fixed C-arm** is especially well suited for ORs that require more sophisticated imaging applications in a single room.

### 3D imaging

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Orientation throughout the anatomy, also the visualization of organs and bones, can be greatly improved with 3D imaging. It has shown to be particularly helpful for guiding catheters, needles, screwdrivers and awls with more confidence during minimally invasive surgery.

### Power output

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A **C-arm** system with high power output enables fluoroscopic imaging during longer surgeries. For high availability, it is important that the system does not overheat quickly, and is ready to be utilized whenever needed.

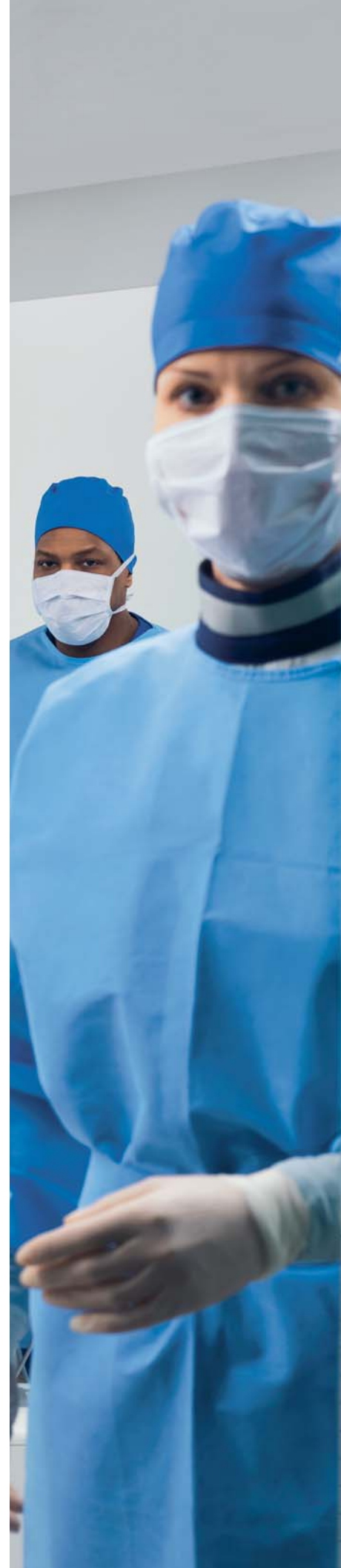
## Navigation is making inroads into the OR

As new surgical therapies and minimally invasive procedures become more prevalent, there is a growing need for high-end imaging systems and technologies to support them. Advanced navigation tools, in particular, play an important role for planning and performing many of these procedures.

### Positioning in three dimensions

Precise positioning is critical, particularly for delicate operations on organs and anatomic structures such as the brain or the spine. Navigation tools used in combination with high-resolution imaging provide surgeons with clear and confident guidance through the anatomy.

3D imaging with navigation offers support for accurately tracking and maneuvering surgical devices and instruments such as catheters, needles and guidewires for cardiovascular procedures, or screwdrivers and awls for orthopedic procedures. Navigation tools not only help to increase confidence during procedures, but also facilitate overall workflow and save time and dose. Like a GPS, surgical navigation tools are also very convenient to work with.



## Image-guided systems for hybrid operating rooms

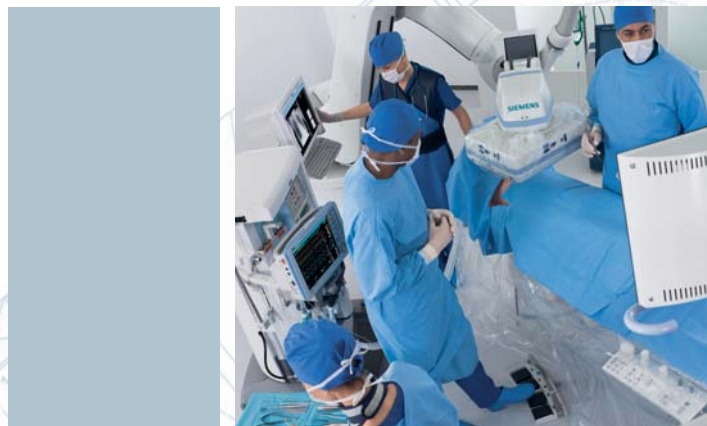
The increasing convergence of surgical and interventional procedures is also impacting the physical environments of many healthcare facilities. So-called hybrid operating rooms capable of supporting both minimally invasive surgical as well as interventional radiological (IR) procedures are becoming more and more commonplace.

### High-powered hybrid imaging equipment

In addition to advanced surgical equipment, these facilities generally feature high-end image-guided systems and navigation technologies. Complex transcatheter techniques, for example, rely on high-powered imaging equipment to visualize thin guidewires and to quantify small vessels and delicate anastomoses.

### The importance of good planning

Appropriately designing and equipping an integrated endovascular suite is, first and foremost, dependent on the procedures to be performed – now and in the future. However, other factors such as workflow are equally important. Thus, installing a hybrid room requires careful planning.





## Fixed C-arms



### **AXIOM® Artis U**

As a “room-mobile” imaging system, AXIOM Artis U combines the versatility of a mobile C-arm with the high power output of a fixed C-arm.

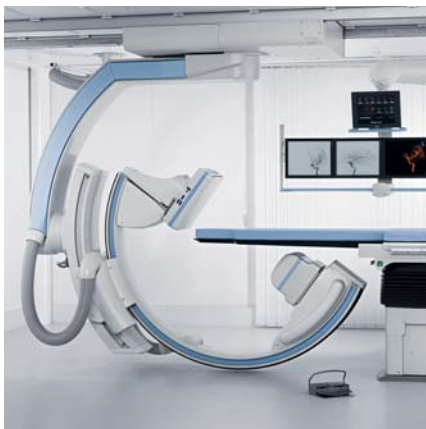


### **Artis zee® floor-mounted system**

A real space saver in the OR with a small footprint, the system allows for convenient patient access from both sides of the table.

High-end angiography units and fixed C-arm systems in general provide ideal imaging support for complex and delicate interventions. They pave the way for emerging procedures to treat patients previously considered too ill, and thus, unsuitable for surgery, as well as patients at very early disease stages for whom surgery had been judged too invasive until now.

## for surgical angiography suites



**Artis zee ceiling-mounted system**  
Full patient coverage combined with flexible working positions and easy patient access are just some of the system's many advantages in the OR.



**Artis zeego®**  
The first-ever interventional C-arm system to employ robotic technology. Its exceptional flexibility and unique imaging applications make it an ideal system for OR environments.



**Artis zee biplane**  
The biplane system offers excellent coverage and flexibility for the complete applications spectrum, including neuro, spine as well as pediatric imaging during surgery.



**SIREMOBIL® Compact L**  
SIREMOBIL Compact L is our compact all-around performer for various surgical applications such as general surgery, orthopedics, trauma surgery, pain management and ambulatory care.



**ARCADIS® Varic**  
ARCADIS Varic is our advanced multi-purpose C-arm for a broad range of applications like orthopedics, trauma and vascular surgery or urology, for streamlined workflow and outstanding image quality in the OR.



**ARCADIS® Avantic**  
ARCADIS Avantic is our high-end multi-purpose C-arm with brilliant image quality for a vast range of applications, including cardiac surgery, vascular surgery, gastroenterology, orthopedics and many other fields of practice where power and a large field of view are required.



## Mobile C-arms for demanding applications in the OR

Siemens has a broad lineup of mobile C-arms that combine excellent image quality with unique features designed for easy operability, versatility and efficiency. Straightforward functions and excellent ergonomics greatly enhance handling convenience while simplifying overall clinical workflow in many fields of practice.



### **ARCADIS® Orbic/Orbic 3D**

ARCADIS Orbic/Orbic 3D is our high-end multipurpose C-arm with excellent image quality, isocentric design and 190° orbital movement. The additional 3D functionality of ARCADIS Orbic 3D is best suited for intraoperative use in orthopedic, trauma and spine surgery.

### **Navigation**

ARCADIS Varic and ARCADIS Orbic can be equipped with the navigation interface NaviLink 2D. ARCADIS Orbic 3D can be equipped with NaviLink 3D, combining 3D intraoperative imaging with high accuracy 3D surgical navigation.



**ACUSON AcuNav™**  
The ACUSON AcuNav ultrasound catheter enables procedure visualization and device placement monitoring with a fully functional 8F or 10F intracardiac transducer.



Ultrasound has a vital role in perioperative and intraoperative imaging. Siemens offers a comprehensive range of ultrasound systems to address your needs.

## High-performance ultrasound



### **ACUSON P10™**

The ACUSON P10 ultrasound system is the first pocket ultrasound device for earlier, faster and more accurate decisions at the point of care.



### **ACUSON P50™**

The ACUSON P50 ultrasound system is designed to work smart in any environment. Featuring excellent image quality and full Microsoft® Windows® notebook computing, it raises the bar on portable ultrasound.



### **ACUSON X300 PE™**

The ACUSON X300 ultrasound system premium edition (PE) is a robust yet flexible imaging system. The system's mobility and rapid 12-second reboot provide instant access when fully featured diagnostic capabilities are needed.

# A broader view of surgery

Surgery is constantly changing. Surgical techniques and procedures are changing. Entire surgical landscapes are changing.

As a major innovator in the healthcare sector, Siemens is at the forefront of many medical trends, including latest surgical developments. Through its holistic approach to healthcare, Siemens views surgery from a broader frame of reference. Always viewing individual solutions within the larger hospital operation. In a continuous effort to further improve surgical precision, workflow and quality of care.

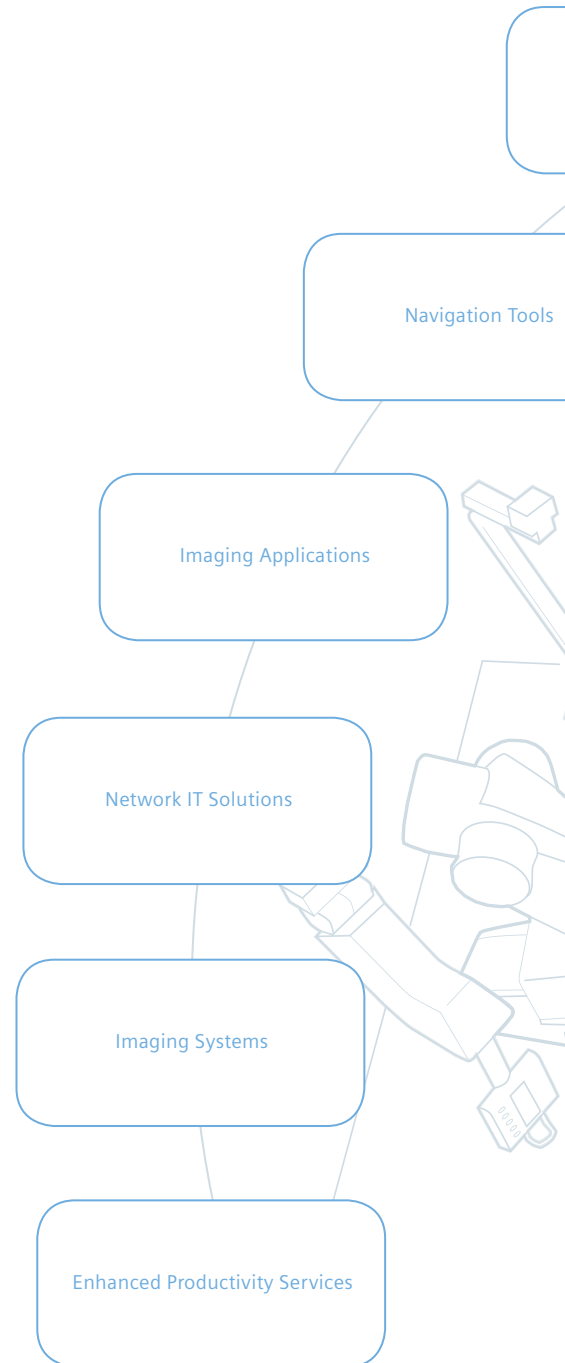
In addition to one of the broadest portfolios of dedicated surgical X-ray and ultrasound systems on the market, Siemens is a leading manufacturer of intraoperative MRI and CT units. Along with state-of-the-art imaging applications, navigation tools and data management solutions. The Siemens surgical offering also comprises advanced network IT solutions, applications training programs and services designed to optimize system performance and utilization.

Moreover, Siemens is a trusted and experienced project management partner for hybrid rooms and related OR facilities. It assists institutions with expert infrastructure planning, design, engineering and installation support.

**Think intraoperative imaging.  
Think Siemens.**



Siemens in cooperation with IMRIS Inc. developed the IMRIS Surgical Suite, which incorporates a moveable ceiling-mounted MRI scanner



The Siemens surgical portfolio covers everything from dedicated imaging systems and applications to network IT solutions, training programs and project management support

Training Programs

Infrastructure Planning

## Comprehensive customer support: Life

With Life, our comprehensive customer care solutions, we help customers get the most from their investment. Life comprises programs and services designed to sharpen skills for optimal clinical value. Our “Customer Education” offerings include mutual workshops with other surgical equipment manufacturers.

[www.siemens.com/life-courses](http://www.siemens.com/life-courses)



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Using the same extensive quality assurance measures as for factory-new components, we guarantee the quality of these recycled components.

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