# Mobile MRI: Revolutionizing Access to Advanced Imaging

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## Historical development of mobile MRI units

The evolution of mobile MRI units represents a remarkable convergence of medical imaging technology and transportation engineering, driven by the fundamental challenge of bringing diagnostic capabilities to underserved populations and remote locations.

**Early conceptualization (1980s)**
The concept of mobile MRI emerged in the 1980s, shortly after magnetic resonance imaging became clinically established in major medical centers. As hospitals recognized the diagnostic value of MRI but faced significant capital investment barriers, the idea of shared mobile units began to take shape. Early pioneers faced considerable technical challenges: MRI systems needed precise magnetic field stability, extensive shielding from external electromagnetic interference, and substantial amounts of power, all of which seemed incompatible with mobile platforms.

The American FONAR Corporation tackled these obstacles with success and introduced the world's first mobile MRI unit in 1983. It received FDA approval in 1985 and began serving multiple separate hospital sites from 1986 [1].

The magnetic field strength on these first-generation mobile systems was typically limited to 0.5 Tesla or less, and image quality was compromised by vibrations and electromagnetic interference from the vehicle's systems.

**Technological breakthroughs (1990s–2000s)**
The mid-1990s marked a turning point, with several key technological advances. Improved superconducting magnet designs allowed for more compact systems while maintaining high field strength. Advanced shielding techniques, including both active and passive electromagnetic shielding, enabled mobile units to operate in various environments without significant image degradation. Vibration isolation systems were developed to minimize the impact of road transport and environmental factors on image quality.

During this period, manufacturers began producing purpose-built mobile MRI trailers with integrated power generation systems, patient areas, and operator consoles. The development of helium recapture systems (zero boil-off) reduced the operational costs associated with cryogenic coolant loss, making mobile units more economically viable and practical for routine clinical use.

## Meeting current global healthcare challenges

Mobile radiology units provided by private companies are emerging as crucial solutions to one of the many pressing healthcare challenges facing the world today.

The World Health Organization (WHO) reports that over two-thirds of the global population lack access to radiology services [2]. This reflects a massive gap in diagnostic capabilities that mobile units are uniquely positioned to address. These flexible, transportable imaging solutions tackle inequities in healthcare access by bringing advanced diagnostic capabilities to underserved communities, rural hospitals, and regions with limited infrastructure.

The momentum gained during the last 10 years is attributed to the rising demand for decentralized healthcare, reflecting a broader shift toward more accessible, patient-centered care delivery models.

The growth of the mobile radiography industry is primarily driven by an increase in chronic diseases, necessitating more frequent diagnostic imaging. Another factor is its ability to address critical shortages in the healthcare workforce by providing imaging services without requiring investments in permanent facilities and long-term staffing commitments.

Mobile units offer rapid deployment capabilities for emergency situations, temporary coverage during equipment maintenance, and scalable solutions for varying patient volumes. In doing so, they provide a strategic response to the dual challenges of expanding healthcare access while maintaining cost-effectiveness in an increasingly resource-constrained global healthcare environment.

## Operational models

**Trailer units** are true mobile MRI systems housed in large semi-trailers that operate as scanning rooms. They are magnetically shielded and can be transported with the magnet fully energized to minimize setup time at each location.

Trailer units are designed for maximum mobility and can be easily moved between facilities on a regular schedule. With an overall size of approximately 15 × 3 meters, the units are typically used in route-based operations. This means they follow predetermined routes between multiple healthcare facilities, spending days or weeks at each location before moving to the next site. They are ideal for serving rural areas, smaller hospitals, or facilities that need temporary MRI access during equipment maintenance, replacement, or surges in demand.

**Relocatable units** are oversized trailers that can be semi-permanently parked at a hospital or imaging facility and function as a bridge between mobile trailer units and fixed installations. A relocatable unit provides ground-level access and a spacious environment for patients and staff. It is a good option if a facility is considering a long-term imaging solution, as the unit can be fully integrated into the hospital infrastructure, maintaining the patient pathway.

These units are typically deployed for months or years at a single location. Compared to the capital investment for a permanent installation, a relocatable MRI unit can provide the most cost-effective way of meeting increasing clinical demand.

Relocatable units are commonly used when facilities need expanded capacity but want to avoid the time and expense of permanent construction, or when testing market demand before committing to a permanent installation.

Each model has distinct advantages in terms of cost-effectiveness, scheduling flexibility, and resource utilization. The optimal choice will depend on factors such as patient volume, geographic distribution of facilities, and local healthcare infrastructure requirements.


**1** A 1.5T MAGNETOM Viato.Mobile deployed in a trailer unit in Spain.


**2** A 1.5T MAGNETOM Sola deployed in a relocatable unit in the UK.

## Current state of mobile MRI technology

Mobile MRI technology has reached a significant level of maturity and adoption. The field has seen important technological breakthroughs, particularly in sustainability and operational efficiency.

In February 2024, we at Agito Medical received the world's first helium-free mobile MRI scanner for our fleet. It reduces environmental impact and operational costs and marks a significant step forward in sustainable healthcare technology. This development addresses one of the major operational and financial challenges of traditional MRI systems: helium dependency.

These sealed MRI systems also have practical advantages, allowing safe transport thanks to simple ramp-up/ramp-down procedures. They also enable optimized positioning, as they are not constrained by a quench pipe, which traditionally requires careful distancing from structures and personnel.

Another breakthrough concerns innovative measures for reducing power consumption, such as switching MRI units off and enabling power-save mode. The power-save mode works by cycling cooling components on and off when the MRI is not in use, rather than keeping all systems running continuously. This maintains the magnet's superconducting state while reducing energy consumption during idle periods. The technology is especially effective for facilities and mobile units that operate during specific hours, allowing significant energy savings overnight and during weekends.

These power-saving technologies are a win-win solution for healthcare providers: They substantially reduce costs while contributing to environmental sustainability goals without compromising imaging quality or patient care.

In addition, optimized system reliability and remote service capabilities enable real-time diagnostics, predictive maintenance, and instant technical support. This significantly reduces downtime through proactive issue resolution and by eliminating the need for on-site technician visits for routine troubleshooting. In turn, this maximizes scanner availability and operational efficiency while lowering service costs.

All the above features are ideal for mobile MRI systems, which must operate reliably in challenging environments characterized by vibrations, frequent transportation between locations and regions, support from multiple technicians, and deployment across diverse clinical applications.

## Outlook and emerging trends

The future of MRI technology is rapidly evolving, driven by several transformative trends that promise to continue revolutionizing mobile imaging over the next decade.

### More helium-free systems

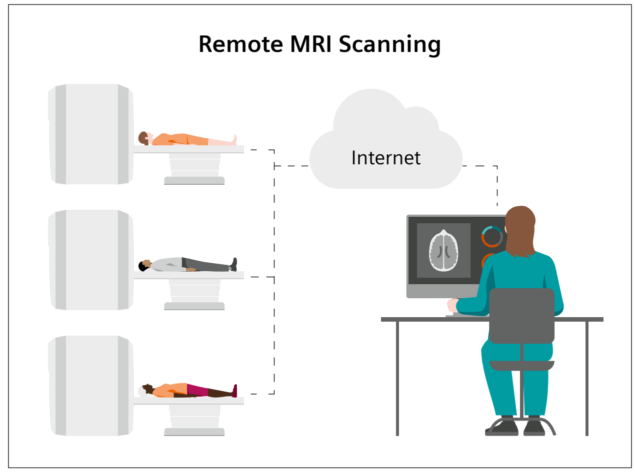
As mentioned above, the first "helium-free" unit was deployed in our fleet in 2024. We are excited to see other vendors either developing or offering such technology now too, as it is truly a match made in heaven for mobile MRI units.

The question now is whether and when the recent research into next-generation superconductivity with more-accessible nitrogen-cooled copper-free and nickel-based superconductors, or perhaps even the new LK-99 superconductor [3] that South Korean researchers claim can operate at room temperature, will become a reality in MRI technology.

### Artificial intelligence

AI has significantly transformed clinical radiology by enhancing image quality, reducing scan times, and improving diagnostic accuracy and patient safety in MRI. These applications are streamlining workflows and increasing acquisition efficiency and speed, while maintaining superior image quality.

This is probably only the beginning of the AI evolution. In the near future, we are likely to encounter AI technology that can transform both the patient experience and diagnostic capabilities through, for instance, advanced Compressed Sensing and deep learning-based reconstruction that enable faster image acquisition without compromising quality. We are also likely to see AI technology offer fully automated image reconstruction, protocol optimization, and preliminary analysis to help radiologists focus on complex diagnostic decisions.




3 The concept of remote scanning.

## Remote scanning

Remote MR and CT scanning has evolved significantly. Several key technological advances are now FDA approved and have been clinically implemented by both independent vendors and major MRI manufacturers. One such solution is *syngo* Virtual Cockpit from Siemens Healthineers, which reflects the broader trend toward remote scanning capabilities across the industry.

This infrastructure is very well suited for mobile scanners. It expands the reach of skilled technologists, especially in rural and underserved areas where these units are often in operation.

Assuming regulatory and compliance barriers are addressed, and the concept is optimized and fully adopted, we might very well see new mobile MRI or CT units developed specifically for remote use. They would have a different and optimized layout: Since less space would be needed for the technologist, patients would have a larger and better environment.

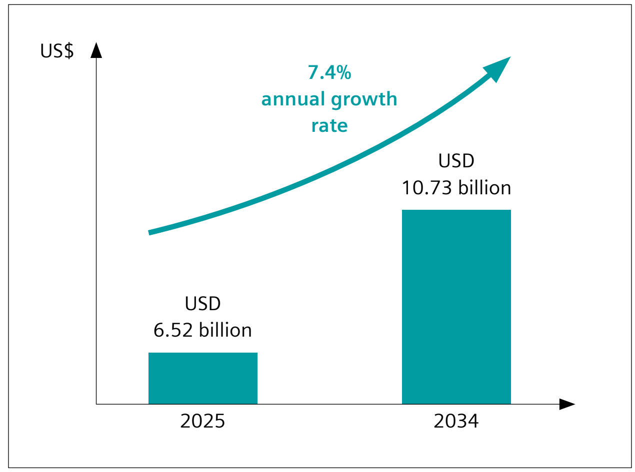
## Patient-centric innovations

The industry is increasingly focusing on patient comfort and accessibility. Patient-centered technology, such as wide-bore systems, in-system entertainment, low-acoustic-noise scanning, lightweight coils, and free-breathing scanning, will continue to be an important goal for MRI in the 21st century and will greatly impact the mobile environment as well.

## Conclusion

Today's mobile MRI units serve diverse populations worldwide, from rural communities in high-income nations to underserved regions in low- and middle-income countries. These systems have proven particularly valuable in disaster response scenarios, military medical support, and population health screening programs. The concept of mobile units continues to evolve with advances in artificial intelligence, power and helium optimization, and remote scanning.

Research estimates that the global mobile scan market will reach US$ 10.73 billion by 2034, up from US$ 6.52 billion in 2025, which represents a 7.4% annual growth rate [3]. Growth drivers include rising demand in underserved areas, and screening programs. North America and Europe currently dominate adoption, while Asia-Pacific markets are expanding rapidly.




**4** The global mobile scan market is estimated to reach US$ 10.73 billion by 2034, up from US$ 6.52 billion in 2025 – a 7.4% annual growth rate. *Figure reprinted with permission from [4].*

### References

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