





04

Amadeus technology

4.1 Research & Development

Amadeus' world-class technological excellence has its roots in our worldwide network of Research & Development (R&D) centres. This is where tomorrow's solutions for the travel and tourism industry are being created.

We are committed to continuously investing in R&D and providing the expertise and added value that our customers need - both now and in the years to come.

Indeed, our R&D investment enables us to offer some of the most advanced, integrated and powerful business tools available in the market. In terms of R&D investment in the travel and tourism industry, we are ranked number one in Europe and are amongst the first in the world. Over the years, we've established close collaboration with research teams in leading institutes throughout the world, such as the Massachusetts Institute of Technology (MIT) in Boston (on revenue management mathematics), ETH - Swiss Federal Institute of Technology - in Zurich (on high performance systems engineering), and Institut National Polytechnique (INP) in Grenoble (on airline schedule & operations)

Amadeus' R&D teams conceive, design, develop and maintain some of the world's most complex, widely available, real time information systems accessed by hundreds of thousands of travel professionals and end-users.

Our customers rely on Amadeus to provide a clear vision and direction to shape the future of the global travel and tourism industry.

World class technology

25 years ago, the decision to base our architecture on a **community system** shared by airlines and travel agencies helped give us an advantage over our competitors. Today it continues to make that same difference.

Thanks to our continued R&D investments, Amadeus has become the industry's number one technology partner. Our expertise and leading solutions are widely acknowledged by the travel and tourism sector's leading players.

In recent years Amadeus' R&D efforts have been particularly focused on:

- > Extremely high performance transaction processing under stringent system availability and dependability requirements;
- > Information mining from very large data-bases;
- > Super-responsive travel search engines;
- > Multi-channel customer servicing applications (agent desktop, web, kiosk, mobile, tablets);
- > Pioneering the use of open systems

Our modern architecture based on **open systems**, with multi channel components and services, enables us to provide greater innovation and more and more powerful functional solutions in a shorter timeframe, therefore responding faster to industry needs. It also enlarges our range of travel solutions. With the Altéa suite for airlines, Amadeus has the first airline Passenger Services System (PSS) ever operated on new generation technology. This innovative suite of solutions is capable of delivering the core requirements of airlines whilst at the same time allowing carriers to propose differentiated services to their passengers.

True partnership

Amadeus was founded by airlines. From the start we adopted a partnership philosophy to develop solutions for airlines and travel agencies. In-depth knowledge of customer needs is a key component to conceiving our tailor-made solutions that reduce costs, boost productivity and increase revenues - all the while improving customer service.

Amadeus has a proven track record of working in partnership with our customers on large projects.

Amadeus, Qantas and British Airways have been working together since 2000 to develop Altéa, the next generation Passenger Services System which is now used by 109 airlines throughout the world. Our unique community approach to the development of airline IT solutions reinforces our position as a true partner to our customers.

In 2012, we have successfully continued growing our portfolio, into **Revenue Accounting**: British Airways has become the first airline to sign for Amadeus' new Passenger Revenue Accounting solution and is scheduled to migrate to the new solution in early 2014. This strategic partnership with British Airways demonstrates that both companies share the same vision for a next generation passenger revenue accounting solution, built using modern technology and embracing the latest industry standards and which enables real-time revenue monitoring for faster, more accurate revenue decisions.

Amadeus also made inroads with Ground Handling Companies thanks to Altéa **Departure Control Systems for Ground Handlers**, a community platform developed by working closely with ground handlers.

To boost the sale of rail products and ease rail operations, Amadeus has been cooperating closely with large European rail providers and major Travel Management Companies to create **Amadeus Total Rail**. The solution enables railways to manage operations and sell seats across multiple sales channels and allows travel sellers access to book rail and air services side-by-side within the same solution. The offering includes Amadeus Global Rail Sales Platform, which is the first rail GDS on offer, and Amadeus Rail Operations Engine, which allows railway companies to manage schedules, inventory, fares and pricing.

In the online travel flight search area, Amadeus delivered an industry first solution making flight search more relevant and simpler for travellers with **Amadeus Featured Results™**. This solution, which instantly delivers the four most relevant bookable travel options available - fastest, cheapest, most popular and sponsored, was presented at the PhoCusWright Travel Innovation Summit in Arizona, U.S.A. Vayama, a leading online travel agency uniquely focused on international travel, was our partner to design and pilot the solution in beta form on its website, including 100 origin and destination combinations.

Also this year, Amadeus signed a global partnership agreement with Akamai, the leading cloud platform for helping enterprises provide secure, high-performing user experiences, to improve the performance of all web-based applications used by Amadeus and its customers, including airline e-Commerce websites and Amadeus' own suite of booking tools. Airlines, travel agencies and TMCs will all benefit from improvement in online responses of up to five times previous speeds, leading to increased revenues and a cutting-edge user experience.

Technological excellence spanning the globe

In 2012, Hervé Couturier, was appointed Executive Vice President of R&D, following the retirement of Jean-Paul Hamon. Hervé Couturier, who brings with him some 25 years of international software development experience gleaned from previous high-profile roles at SAP, IBM and Business Objects, is heading up Amadeus' 4,500+ strong software development organisation across its 16 different sites worldwide.

Under Hervé's leadership, a continuous improvement programme was launched, spanning the entire R&D scope and aiming at further progress in innovation, operational excellence and software development efficiency.

Sophia Antipolis (Nice) is Amadeus' central headquarters for R&D activities, with on-site and worldwide teams developing solutions for travel distribution, e-Commerce, points-of-sale, airline, hotel, rail and airport IT.

Our global networked organisation includes the central R&D centres of Sophia Antipolis, Bangalore and Boston, the R&D sites of London, Sydney, Aachen, Antwerp, Frankfurt, Miami, Strasbourg, Toronto, Tucson and Istanbul as well as regional centres in Bogota, Warsaw, and Bangkok.

Our R&D centre in Bangalore, created in 2008 in partnership with Ness Technologies, whose mission was to help us build and operate the centre in its initial phase, is since June this year a fully-owned Amadeus entity. This forms part of our strategy to extend our global R&D footprint and reach out to our customers in different regions of the world.

All sites provide our staff with stimulating environments that enhance creativity and help spark innovative ideas. They also bring together a wide range of expertise and a worldwide approach to developing global products. A transversal division is supporting, via competence driven governance rules and communities, the cross fertilisation between sites in the domains of architecture, software engineering, project management, common best practices and tools.

Process improvement has always been a constant, systematic initiative in Amadeus. We were the first GDS to receive quality certification (ISO 9001:2000). We continue to deploy a Capability Maturity Model Integration (CMMI) approach to software development and received additional certifications in 2012.

Our methodologies are evolving and now support different approaches to product development, from very large projects involving hundreds of people to small and mid-size agile projects, with very frequent deliveries and evolving requirements.



Amadeus employees

As part of our dedication to developing world class technology, Amadeus has long been engaged in a patent programme for collecting and reviewing patent propositions and coaching inventors in their drafting process.

Proven Results

Thanks to the vision of our R&D teams, Amadeus is able to demonstrate both the commitment and results to ensure the future success of our customers.

- › In 2012, the European Commission ranked Amadeus' investment in research and development technologies for use in the travel sector (over €414m in 2012, an increase of 20% on 2011) as the largest in Europe by total research & development investment in the travel and tourism sector. Innovation is one of the drivers behind Amadeus progress and growth, which has allowed the company's technology to achieve an outstandingly competitive position within the market.
- › Amadeus will be the first IT provider to the airline industry which has most of its systems on open source software and fully replaced mainframe proprietary environments with open source and widely used commercial software. In 2012, Amadeus published 'Open for business', authored by leading technology expert Professor Jim Norton. The report made the case for the travel industry to embrace open source software in order to benefit from greater innovation, respond faster to industry change and reduce costs, whilst freeing the industry from its reliance on proprietary software to provide greater competitive advantage. Leading innovations online, including Amadeus e-Retail, Amadeus Dynamic Website

Manager and Amadeus Extreme Search have been built with extensive use of open source components in a way that would not be possible using legacy components. Amadeus ARIA™ Templates – the framework upon which Amadeus IT Group's web solutions are based – was recently made open source, allowing third party developers to use it without charge.

- › In the hotel segment, we continued the development of the Amadeus Hotel Platform, a solution for hotel chains which combines central reservation, property management and global distribution systems into one fully integrated platform.
- › Our online corporate travel booking tool, Amadeus e-Travel Management (AeTM), has undergone a completely new workflow redesign, streamlining the booking process itself, making it easier and faster to search, book, review and approve. We also introduced a mobile booking app, Amadeus e-Travel Management Mobile. This new tool allows travellers to make new air and rail bookings via their mobile devices including iPhone and Android, ensuring efficiency and continuity of service for travellers on the road.
- › Amadeus is the global leader in online travel technology and corporate travel management solutions. We service over 280 airline websites in more than 110 countries and power the self-booking websites of 6,000 corporations. Amadeus is the world's largest processor of online bookings, with half of the world's top 50 airlines using the Amadeus e-Commerce airline suite. We serve over 650 million page views every month and 10 million unique visitors every day.

4.2 The Amadeus Data Centre

The Amadeus Data Centre in Erding, Germany opened for operations in January 1990. The purpose-built facility was designed by engineers with extensive experience in establishing military and commercial data centres. It is fully owned and managed by Amadeus and we are the sole occupier. This ownership provides us with full control of the physical environment and removes any reliance on third parties for security and data protection matters. Additionally, it optimises the efficiency of our development organisation – not only through integration processes and tools but also the flexibility it creates and the dedicated support we can give to creative, new solutions.

Our 20+ years of experience running a first class data centre coupled with the strong commitment to continuous investment in latest technology, progressive automation, and adaptation to international and industry standards

lets us stay ahead of the curve. Today, more than 430 airlines, more than 250,000 hotel properties, more than 100 rail providers, and other travel providers depend on the systems hosted and maintained at the data centre facility to deliver over 3.7 million net bookings on peak days. The facility also hosts and manages the passenger service and Departure Control Systems for more than 100 airlines, as well as numerous other IT solutions for travel management companies, hotel companies, and many other players in the travel and tourism industry.

Amadeus' solutions are offered in a SaaS (Software-as-a-Service) model hosted primarily on Open Systems and highly scalable hardware on more than 7,500 servers at the facility. The Amadeus Data Centre is one of the largest data processing centres dedicated to the travel industry and we are committed to service excellence for our customers.

1.6+ billion
transactions per day (peak)

<0.5 sec
average system response time

3.7+ million
bookings per day

19,000+
transactions per second (peak)

13+ billion
SQL executions per day

3,400+
IT changes per month

9,000+
physical IT infrastructure
devices

13
Petabytes* storage

400+
application software loads
per month

* Peta = 10¹⁵ = 1.000.000.000.000.000

The building and its physical security

The bunker-like building has metre thick, steel reinforced concrete walls and ceilings. It's shaped like a pentagon with 6,000 square metres of fully equipped computer floor space. The internal configuration of the data centre is designed to further increase the resilience of the service in case of failure of any single component.

Security is always of the highest importance to our operations and it starts with the physical security of the facilities. A fence, monitored with perimeter radar and cameras, surrounds the premises and a trench prevents possible attacks using vehicles. Infrared observation is installed on the roof and inside the building a network of cameras is set up for surveillance. The observation systems are linked to the security control centre manned 24 hours per day / 365 days per year by a professional security company.

- > 140 cameras inside and outside the complex
- > 3,000+ sensors with central control
- > 18,000+ data points for the building management system

All rooms are equipped with fire alarms and active and passive smoke detection systems. Server rooms and technical units are equipped with CO₂ extinguishing systems and sprinklers. Emergency procedures involving the local fire brigade are tested on a regular basis.

Compliance with international standards and certifications

Through our continuous strive for excellence, Amadeus was the first global distributor to achieve ISO 9001:2008 Quality Management certification. This certification, which Amadeus has always successfully renewed since 2000, was again granted in 2012 by BSI Group.

Three times per year, Amadeus Data Processing is audited by Bureau Veritas to ensure business continuity and security measures are maintained at the highest level. This environmental investigation is based on numerous British, ISO, and US federal standards as well as hardware install standards. Amadeus Data Processing has been awarded and maintained this certification at the highest grade level for many years running.

Amadeus' security control, policies, and procedures are examined, measured and validated annually against the PCI DSS requirements defined by the PCI Security Standards Council. Amadeus IT Group S.A. first achieved certification of PCI DSS compliance in 2009 and has maintained this certification ever since.

Amadeus also undergoes an annual audit according to the SSAE16 standard to provide our customers an attestation of the effective implementation of internal controls.

Additionally, the Amadeus Data Centre first achieved certification as an 'Energy-efficient Enterprise' by the internationally recognised organisation TÜV Süd in March 2010. This certification was renewed in 2012.



The principles of minimum n+1 and no single point of failure are applied to all functions at all levels.

A few 2012 highlights

Furthering the move towards Open Technology

Amadeus Data Processing continued its move towards Open Source operating systems in 2012. With this ongoing transition from proprietary systems to Linux, we now see Altéa Reservations, Inventory and Departure Control Systems substantially running on open systems.

Opening of energy annex

In response to the ever increasing need for processing power, in 2011 Amadeus commenced the construction of an energy annex. This annex came into operation in April 2012. The addition to the data centre facilities nearly doubled Amadeus' capacity to 6.0 MW UPS power and 6.6 MW cooling production.

The new, more energy-efficient equipment now significantly contributes to the supply of the facilities and supports our continuous commitment to efficiency improvement. The energy annex houses:

- > Three diesel UPS systems with powerbridge at 1,2 MW each
- > Two cooling machines with 1,5 MW each
- > One free cooling unit of 1,5 MW
- > Three 20 kV transformers
- > One 30,000 litre diesel tank hold the fuel required to generate power for the annex in case of an outage

Continued focus on Green IT

Amadeus' focus on the energy efficiency of its power supply, cooling and climate control processes, IT equipment used, as well as the facility's procurement, installation and de-installation processes and procedures resulted in the certification as "Energy-efficient Enterprise" in March 2010 by TÜV Süd. The certification was renewed in 2012. This focus also enabled us to continue the reduction of our annual Power Usage Effectiveness (PUE) ratio from 1.49 in 2009, when we began closely monitoring and recording this value, to 1.42 in 2010, 1.41 in 2011, and still further to 1.39 in 2012. The latest survey by Uptime Institute states an average value for data centres is between 1.8 and 1.89.

Constant service improvement

In our ongoing drive for service excellence, Amadeus launched in 2012 a corporate initiative to review all core business services and applications in an effort to increase resilience and improve operability. Key areas of the programme are infrastructure and architecture resilience, incident management, monitoring and diagnosis, application operability and resilience, as well as release management and testing. The more than 80 projects launched as a result of this programme are scheduled to be implemented over a period of 18 months.

In 2012, Amadeus launched a corporate initiative focused on infrastructure and architecture resilience, incident management, monitoring and diagnosis, application operability and resilience, as well as release management and testing

Amadeus global operations

Follow-the-sun concept

Amadeus operations is based on a follow-the-sun model with operation sites in Erding (Germany), Miami (USA), and Sydney (Australia), as well as specialist operations support groups in Bad Homburg (Germany) and London (Great Britain). Although the primary site in Erding is manned 24x7, the secondary sites become the first point of contact during their business hours, following a formal hand-over. This ensures optimal support for our customers from an office near to them and facilitates us performing maintenance procedures during “off-hours”.

Our truly global operations are supported by approximately 850 employees of more than 50 nationalities.

Amadeus’ operations bridge

The operations bridge is the control centre for our systems, networks, and their supporting infrastructure from which we provide 24x7 support. The recently remodelled (2011), primary operations bridge is located at the Amadeus Data Processing facility in Erding. It supports our focus on customer centric service delivery and our approach of parallel investigations with experts for all technical environments in one room for collaborative and efficient resolution of incidents. In addition to operations bridges in our regional offices, a back-up operational bridge for the Erding site is available, approximately 40 km away, should the prime site become inaccessible.



Amadeus employees