The digital cockpit playbook

What is a digital cockpit?

Automotive interiors in recent decades have undergone a radical change, with the addition and development of dashboard screens, displaying navigation, and other infotainment features.

Known as the ‘digital cockpit’ in the industry, this move to screen-based controls gathered pace as smartphone technology influenced consumer expectations in the 2010s. That said, there has been a return to physical switchgear in recent years, in part as a response to new Euro NCAP safety regulations that will penalise vehicles lacking physical controls for indicators, hazard lights, wipers, horn and SOS functions from 2026.

However, the digital cockpit is more than just some extra screen real estate on a dashboard: it is part of a paradigm shift in the development of future automobiles, as OEMs shift their R&D processes and operating models from hardware engineering to a combination of software and technology-driven systems engineering.

The endpoint of this development is the software-defined vehicle (SDV), but the digital cockpit is indicating the direction of travel.

Enhancing OEM brands

But the digital cockpit represents more than just a switch in emphasis from mechanically engineered hardware to software and electronics. It also offers an opportunity for OEMs to create more brand value with new services and new concepts, and to engage the consumer in the driving experience.

The digital cockpit should offer a seamless in-vehicle experience, responding to the changing needs of the driver and passengers – on different types of journeys or at different times of the day, for example.

The final aspect of the digital cockpit that will help define it is the updatable and upgradable nature of the software, via over-the-air (OTA) updates. This will enable OEMs to stay in regular contact with customers after they've driven away from the dealership. Offering more connectivity options, new apps, or software updates allows more opportunities to build relationships with customers and find out what they want.

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Challenges to digital cockpit adoption

The automotive industry is already facing an array of challenges – and the development of the digital cockpit will present even more to OEMs.

The first challenge is the driver. Do they actually want the services that they can access via a digital cockpit? Is there an appetite for them, beyond consumers who consider themselves early adopters? And are they ready for a car that has access to new services that may require broader access to their personal data, or is that a privacy step too far?

Drivers will want simple solutions from a digital cockpit: they want to be routed from A to B by the navigation; they want to understand what the speed limit is; or they want to find something specific (e.g. somewhere to park) at their destination. Offering this kind of information on a screen is generally welcomed by drivers (and passengers), but they don't want services they find intrusive in their personal space, or are too complicated to use.

OEMs will also have to decide what it is they want their digital cockpits to showcase. A large screen is perfect for a map, but too big if it's just displaying a speed limit, so the screen experience will have to be well designed, intuitive, and easy to use. OEMs will need to think long and hard about the kind of experience they want to deliver and how it reflects the brand and its values.

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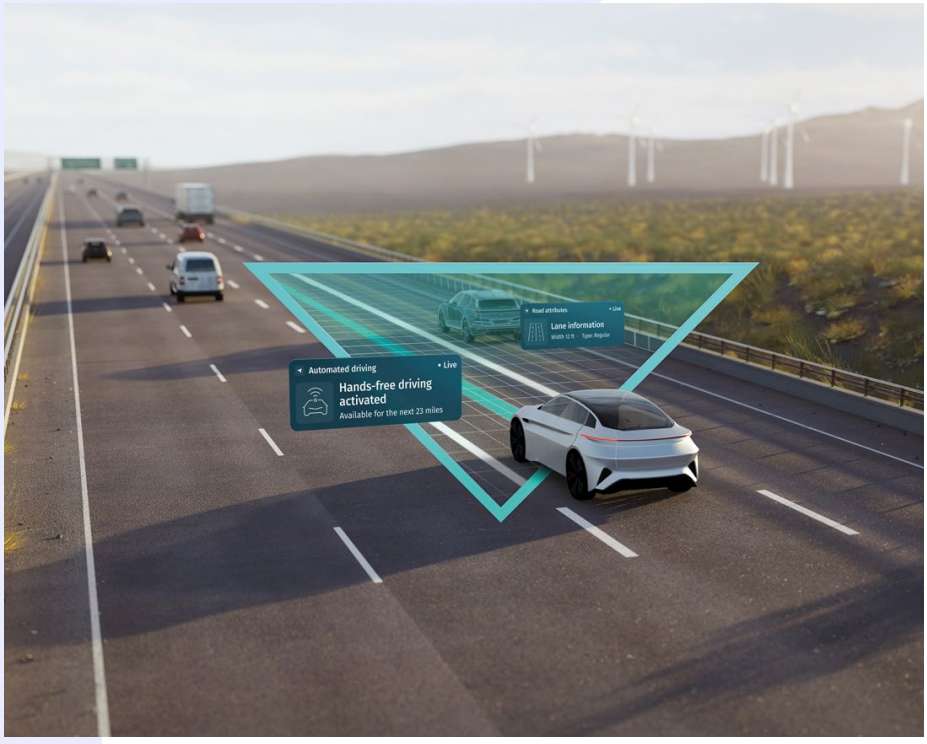
The role of location data

The driver will expect navigation from a high-tech digital cockpit with multiple screens. However, a smartphone can also offer maps and route a consumer to a destination, so the digital cockpit navigation must be more about how it makes the driver's daily life easier.

With a massive screen real estate, how can OEMs best convey assisted or automated driving information? Navigation is no longer just about finding POIs or planning routes: it now includes lane-level guidance, speed limit alerts, and contextualizing driving with location, to deliver a seamless, integrated driving experience.

This contextualization, powered by location data, can add value for the driver and enable the OEM to offer more services to them.

As more vehicles move towards L2+ and L3 autonomous driving, drivers will be able to operate the car with their hands off the steering wheel and eyes off the road (hands off/eyes off). This frees them up to do other things and offers OEMs new opportunities to offer new uses cases in the digital cockpit (gaming, shopping, etc).



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Strategic trends driving the digital cockpit

A number of current trends in the global automotive industry will have a major influence on the development of the digital cockpit in the coming years. The development of autonomous driving, connectivity, electrification and shared mobility – known collectively as ACES – along with AI and new software ecosystems, will all dictate the future direction of the driver's in-car experiences.

There are still many questions about the development of autonomous driving (AD), particularly in respect of Level 3 and beyond – to the extent that many OEMs are currently not planning to develop anything above Level 2, because of the sizeable safety and liability concerns, and the additional cost of bringing this technology to their customers.

The move towards SDVs, however, will be a primary driver for the digital cockpit, as the technology used by the latter will be a necessary foundation for the entire vehicle being software defined.

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The role of AI

In common with many other industries, the automotive sector is also coming to terms with the development of AI and its role in the digital cockpit. OEMs are already integrating AI into in-vehicle infotainment (IVI), such as using ChatGPT for intelligent virtual assistants in the car and advanced driver assistance systems (ADAS).

OEMs have already launched generative AI-powered, voice-based user guides for the driver to use inside the vehicle. This enables drivers to interact with the car about its features and screen information, with an AI small language model (SLM) being continuously kept up to date via software.

AI also has a role to play in the digital cockpit's navigation and location functions. Anecdotal evidence suggests that location-based requests represent over two-thirds of the prompts for an in-car assistant.

However, perhaps the best use case for AI in location is its analytics ability, which means AI helps deliver better map quality, better software and, potentially, a more intuitive user interface. The real benefit of AI will be that it will learn from the masses of data it ingests, to help create a better navigation product at a faster pace.

That said, the combination of an AI-powered virtual assistant and AI enhanced location will mean that the digital cockpit could respond to the driver asking out loud for the closest charger for their EV, or dining options, based on current location and then navigating to a suggested location.

Remote updates

OTA updates of vehicle's software will also be a major change for the automotive sector.

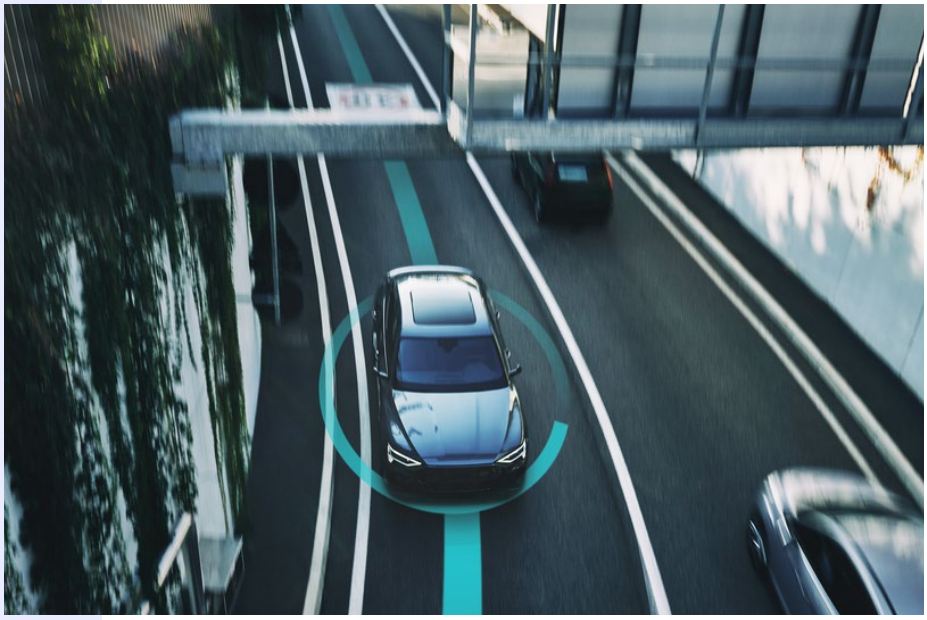
The three main application areas for OTA updates are security updates, bug fixing and the rollout of new features. This last category of updates could underpin future life-cycle management, increasing customer satisfaction and experience, provide better value stability for used cars, and reduce warranty and maintenance costs.

A systematic approach to OTA updates, and their deployment to vehicles, will be important. This means that OEMs must establish a road map for software updates, while having complete oversight on all the components and vehicles affected by each update. This process will demonstrate OEMs' full control over interdependencies and minimize any potential unintended consequences.

OEMs will need to embrace data-enabled engineering and virtual engineering capabilities if they're to gain a complete understanding of what will drive value among customers in the new software-based ecosystem. Carmakers will also need to implement a big-data infrastructure and architecture, to facilitate this data-enabled engineering and virtualization.

These engineering capabilities don't come naturally to organizations that have relied on mechanical engineering for their entire history. For the development of the digital cockpit and SDVs, OEMs must decide whether to add these new capabilities to their organization, as direct subsidiary companies, or partner with organizations that already have a track record in these areas.

Despite heavy investment in in-house software developers by some OEMs, the industry is beginning to understand that this type of R&D setup is not only expensive, but development is also slower than the more agile new brands from China currently launching products with more digital technology. This expertise gap will need to be filled by new partnerships between OEMs and software/technology companies (chip manufacturers, cloud providers, etc), creating new digital ecosystems, allowing OEMs to free up time, energy and resource to do what they do best: spend more time on innovation and differentiation.



Regional trends

The influence of China – the largest global market for new cars – is having a major impact on how OEMs are viewing the need to adopt digital cockpits.

This shift in the global automotive industry's center of gravity will have numerous effects, not least of which will be the need for local strategies that provide incentives for OEMs and suppliers to maintain local footprints and keep data in the region. All market players will have to invest in setting up complex global engineering networks with regional hubs and partnerships.

Chinese OEMs have already started to build software teams and acquire talent to adopt global SDV trends such as ECU consolidation, ethernet penetration and OTA software updates.

China is also important because its consumers are tech savvy and more open to changing brands for better autonomous or connectivity features than in any other market. However, many Chinese customers are also sensitive to price considerations, especially on digital features that require new software technologies to achieve cost-effectiveness.

This experience of building low-cost cars with digital cockpits is also now the foundation for Chinese OEMs' expansion plans. The relatively cheap EVs that are now being exported from China already have software capabilities that are good enough to be put established OEMs under pressure. This already suggests that Chinese car brands are developing software quicker than legacy OEMs, creating disruption in the automotive market - which, in turn, leads to more choice for drivers in those markets, with better and cheaper digital cockpits in vehicles.

The unique online ecosystem in China will mean specific partnerships and technology adjustments for third party-enabled applications, which will mainly require changes to the infotainment software stack.

China-specific regulations – especially those for data-related technologies and cloud infrastructure – will require partly localized solutions in software, such as using approved Chinese cloud suppliers.

This could pose challenges for non-Chinese companies operating in the market (including joint ventures), as well as for domestic companies wishing to export.

Global OEMs will also probably have to develop different ADAS/AD software for the Chinese market, given the different requirements and specific regulatory barriers. Different AD hardware in China will also be needed, because of the need for hardware and software codesign in AD, and the potential risks of export restrictions. In the digital cockpit, a China-specific software stack will be required to address different customer requirements and regulatory barriers.

Automotive use cases

Navigation

Navigation is central to the digital cockpit, with location data being used by the system to understand factors such as speed limits and lane-level information which delivers a safe and seamless in-vehicle experience.

But location services in the digital cockpit are not limited to navigation and routing. As OEMs try to offer more personalized experiences, location data can be used to make the customer's life easier. For example, historic data about where the vehicle travels – and stops – can help with suggestions for parking, dining or entertainment, at places the driver visits regularly. Commercial partnerships between OEMs and the likes of parking providers and restaurant chains can also use data to offer deals such as money-off coupons to drivers.

As the digital cockpit becomes part of the SDVs that will start to appear in showrooms over the next decade, location will continue to be a central function. A unified map will simplify SDV integration, offering a flexible platform for advanced features and creating an immersive driver experience.

See our solutions

Relevant products:
HERE Navigation SDK
HERE SDK

Lotus Emeya electric hyper-GT relies on HERE Navigation

The Lotus Emeya comes equipped with HERE Navigation's EV Range Assistant package, including charge point POI search, multi-stop routing, range-on-map and range-on-route, and fresh and accurate maps.

Read more

Dacia selects HERE Navigation for latest Duster and new Spring

HERE Navigation is a cloud-based navigation application for connected vehicles. It means drivers benefit from automotive-grade maps, real-time traffic information and turn-by-turn voice guidance.

Read more

Sony Honda Mobility uses HERE Navigation SDK in Afeela digital cockpit

A joint venture between Sony and Honda, Afeela employs HERE Navigation SDK for the digital cockpit and HERE SDK Explore for its mobile application, all powered by HERE's unified mapping architecture.

Read more

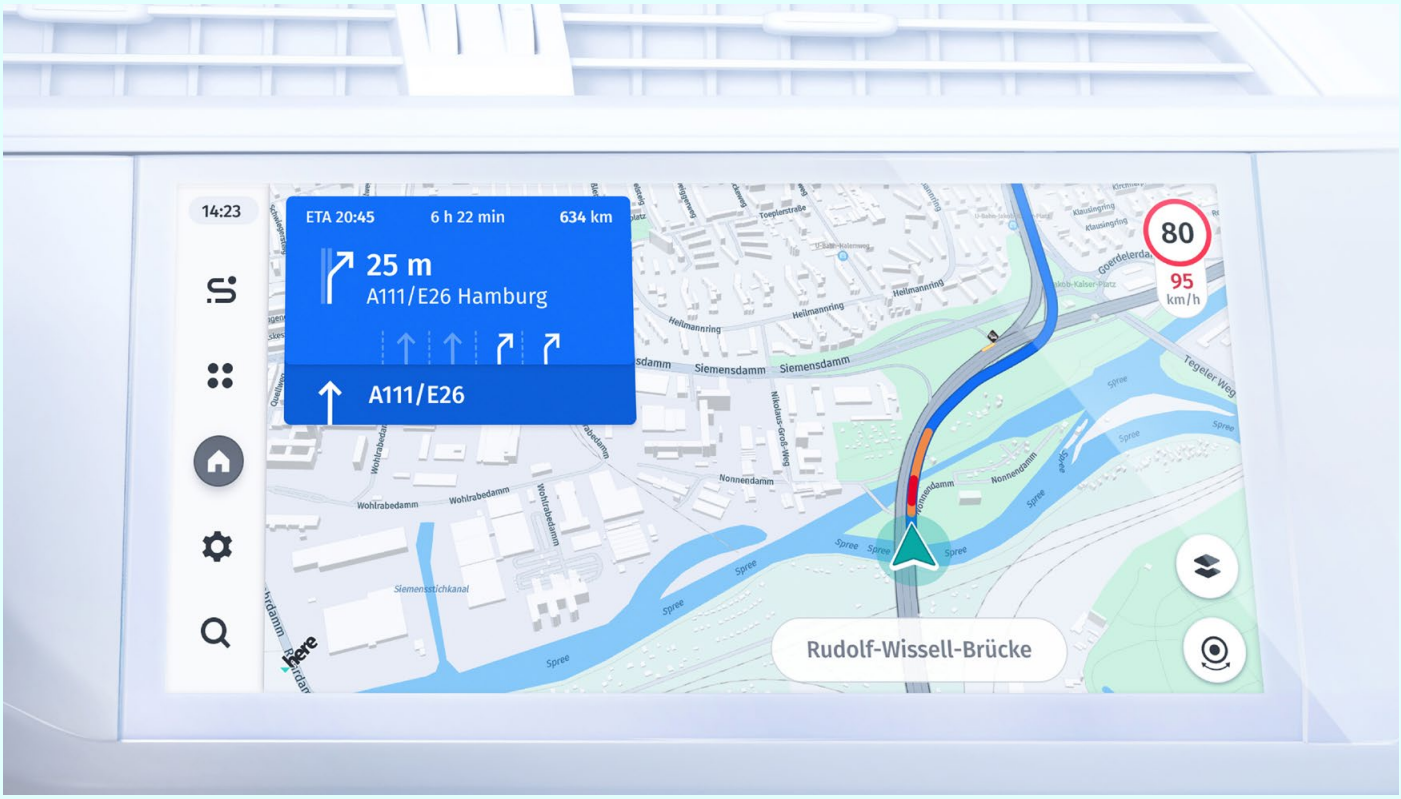
ADAS rendering

If the digital cockpit is to deliver the kind of safe, seamless experiences that it promises, location services must incorporate maps for assisted driving technology, such as ADAS, and speed regulation, such as ISA.

All this data has be to rendered in a way that is seamless, producing maps that are easy to read by the driver. These HD maps provide a level of reassurance to the customer, even as we see higher levels of automated driving in more vehicles. This reassurance, in turn, creates a more engaging experience that is required for consumers to embrace further adoption of these technologies.

Relevant products:

HERE Map Rendering
HERE ADAS Map
HERE ISA Map
HERE Lanes
HERE HD Localization Objects
HERE Road Alerts
HERE Real-Time Traffic
HERE Sign, Signals & Warnings



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EV charging and sustainable mobility

The development of digital cockpits and SDVs comes at a time when the automotive industry is transitioning its powertrains from internal combustion engines (ICE) to the batteries and motors of EVs. This clearly adds a level of complexity – but it also presents opportunities.

We're already seeing location software for EVs supporting their adoption, by using data from battery management systems to improve battery consumption, increase range estimation accuracy, and ease range anxiety among drivers.

HERE EV Routing and HERE EV Charge Points are examples of solutions that enhance location services by automatically populating a route with charging options, at points on the route where they will be needed – even selecting chargers from a company the driver has an account with. AI is also used to predict charger availability when the car needs charging.

In addition, software also takes external factors into consideration, such as traffic density, air temperature, and the elevation, curvature and roughness of the road surface, ensuring that every possible factor affecting an EV's range is accounted for.

The accuracy of such EV routing and charging location software also offers OEMs a better understanding of a vehicle's real-world range – which can inform decisions on the optimal battery capacity for a vehicle and, as a result, create an opportunity for lowering costs.

Relevant products:
HERE EV Routing
HERE EV Charge Points

Togg

Togg and HERE offer personalized driving with intelligent navigation

Togg, an electric and smart vehicle brand from Turkey, has an intelligent cloud-based EV solution, updatable OTA, that adapts to drivers' behavior and preferences, based on HERE Navigation.

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Privacy and the digital cockpit

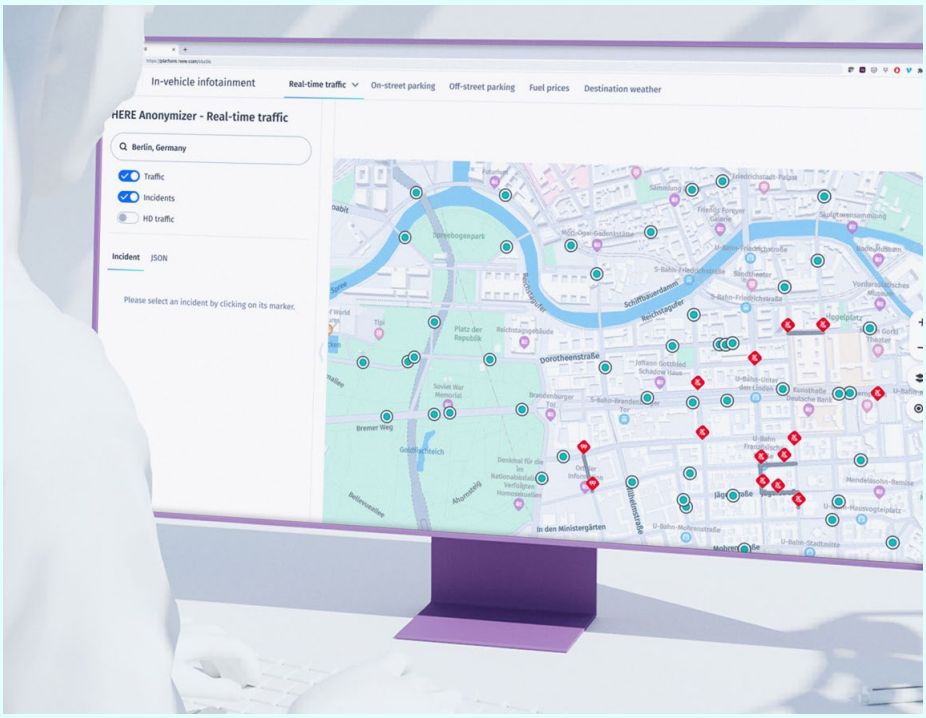
Clearly, any development of the digital cockpit – which will be processing huge amounts of data when the vehicle is in use – will have to consider data privacy laws and regulations, such as European GDPR legislation.

OEMs will want to maintain control of their data, which will influence the choice of partners they work with on a new digital ecosystem.

HERE does not retain control over OEM data, instead using HERE Anonymizer software to protect user privacy while keeping the value of location data at scale.

A close relationship between OEM and location partner, even using anonymized data, results in a positive feedback loop: the vehicle sends data to the location provider, which helps improve its maps, and these more accurate maps offer a better in-vehicle experience.

See our solutions



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Safety and the digital cockpit

The digital cockpit, in and of itself, can't be considered a safety feature, in the same way that we consider seatbelts or emergency braking.

However, it can make a significant contribution to safer driving, whether the vehicle is driven by a human or operates at some level of autonomy in the future. An HD Live Map, for example, acts as another form of sensor, ensuring that the driver and vehicle have the necessary information for any journey, providing context and seeing beyond where the vehicle's sensors can, including from ADAS and Intelligent Speed Assistance (ISA) maps and data.

As previously mentioned, one of the objectives of developing a digital cockpit is to create a seamless in-vehicle experience for the driver and passengers. A live map that brings together different data sources to present an accurate representation of what's outside the vehicle will create that sense of reassurance and safety inside the vehicle.

See our solutions

Relevant products:
HERE HD Live Map
HERE ADAS Map
HERE ISA Map,
HERE Navigation Map

BMW chooses HERE HD Live Map for 7 series

BMW Personal Pilot, a Level 3 highly automated driving function, uses HERE HD Live Map to allow drivers to take their hands off the wheel and eyes off the road, under certain conditions.

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Tools and resources

Digital cockpit

HERE Navigation
HERE SDK

Location Services

HERE Navigation SDK

Unified map access manager

HERE EV Charge points
Truck Attributes

ADAS portfolio

HERE Automated Driving Zones
HERE HD Live Map
ADAS Lane Layer
HERE ADAS Map
HERE ISA Map (incl. HDO, MDP, ADAS Horizon Provider)
HERE Road Alert

Want to learn more?

Find out how HERE can help you move your business forward with location technology

Contact us

About HERE Technologies

HERE has been a pioneer in mapping and location technology for almost 40 years. Today, HERE's location platform is recognized as the most complete in the industry, powering location-based products, services and custom maps for organizations and enterprises across the globe. From autonomous driving and seamless logistics to new mobility experiences, HERE allows its partners and customers to innovate while retaining control over their data and safeguarding privacy. Find out how HERE is moving the world forward at **here.com.**