inmarsat

DEFINING THE FUTURE OF RAIL OPERATIONS

THE ROLE OF SATELLITE CONNECTIVITY

RELIABLE CONNECTIVITY TO SUPPORT EFFICIENT RAIL OPERATIONS

In their ambition for greater efficiency and improved safety, rail operators are always looking to deploy more advanced technologies across their rail networks. These technologies are numerous, ranging from advanced train control systems and next-generation signalling, to distributed power and intelligent cruise control.

However; for this digital transformation to truly progress, rail operators need to be able to access reliable connectivity. Reliable connectivity enables both data transfer and voice communication between locomotives and operations centres and is vital to help maximise safety and efficiency.

The challenge faced by many rail networks operating today is that large areas of their rail networks have coverage dark spots where terrestrial networks fail to provide reliable connectivity, causing operation centres to lose visibility of locomotives and two-way communication to become practically impossible.

Satellite is an important tool in the arsenal of any reliable rail communications network. On the one hand it eliminates coverage dark spots in a cost-effective way, while it also serves as a highly reliable backup communications system when terrestrial connectivity networks fail.

In the past satellite-enabled solutions that provide 'always-on' connectivity for rail operations were deemed cost-prohibitive or overly reliant on unreliable hardware, but much has changed in recent years.

Indeed, in Europe, satellite is being considered a key component of the Future Railway Mobile Communication System (FRMCS) as countries deploy the European Rail Traffic Management System (ERTMS). This FRMCS system will ultimately replace the existing GSM-R network and depends on highly reliable, ubiquitous connectivity, which the appropriate satellite services can provide.

This paper addresses the ongoing challenges of providing ubiquitous connectivity to rail networks and assesses the most comprehensive, economical solutions employing satellite-based technology for rail operators and technology providers.

CONNECTIVITY OPTION ONE:

THE LIMITATIONS OF TERRESTRIAL CONNECTIVITY

For most rail operators, using existing terrestrial infrastructure to support connectivity and communications across their networks has tended to be the default option.

However, there are major limitations to terrestrial connectivity that pose challenges for the rail industry, an industry that by its very nature operates across some of the world's most remote regions where consistent communications previously could not be guaranteed. For instance, there are roughly 32,622 kilometres of railway networks in Brazil alone , with much of these networks operating in coverage dark spots where locomotives cannot communicate with control centres. These dark spots not only leave control centres unable to track locomotives when travelling through these regions, but drivers and maintenance crews are often also unequipped to make emergency contact when they need it most.

Coverage dark spots tend to appear at the limits of terrestrial connectivity, where coverage is either weak and highly unreliable or completely non-existent. This is usually in remote or rural environments with low population density, or where the terrain makes the construction of cellular infrastructure challenging.

While the safety of train operators and maintenance crews is a key concern here, it is also clear that as rail operators rely more and more on the use of technology to improve capacity and efficiency, a lack of reliable terrestrial communication is a barrier to enhancing capabilities. This problem is compounded when crews lack the means to contact headquarters to report on factors that cause delays, such as maintenance requirements which lead to increased network downtime and operational inefficiency.

CONNECTIVITY OPTION TWO:

THE ROLE OF PRIVATE TERRESTRIAL NETWORKS

Where existing terrestrial networks do not provide reliable coverage, some rail operators have turned to commissioning their own private terrestrial networks to plug the gap. This option usually sees the operator or infrastructure manager pay to install connectivity such as fibre cable alongside the track, or Terrestrial Trunked Radio (TETRA) networks, with appropriate infrastructure to 'backhaul' the data to the network or 'cloud'. The advantage of this approach is that once the upfront capital cost of the infrastructure is paid for, the ongoing connectivity cost is relatively inexpensive.

However one of the clear downsides to this is that the upfront capital cost is usually very high, anywhere up to ~$700,000 USD per kilometre of track. The other major issue with this approach is the reliability of the infrastructure: in areas of high risk outages are not uncommon, and could be caused by environmental factors such as landslides or even issues such as wildlife damaging fibre cables. In some cases where the communications are critical to the operation of the train, satellite can be used as a highly reliable backup to private terrestrial networks.

Despite this, private networks clearly have their place in the overall connectivity mix, especially in areas that other forms of connectivity cannot reach, such as in tunnels. In these situations, private terrestrial connectivity can be installed and then backhauled, either by publicly available terrestrial or satellite connectivity at a suitable point.

CONNECTIVITY OPTION THREE:

DIFFERENT TYPES OF SATELLITE CONNECTIVITY

With rail networks often located beyond the reach of terrestrial communication networks, the industry has often been discouraged from investing in providing connectivity to their assets because of the high cost of installing and maintaining terrestrial infrastructure.

With this in mind, there is a key role for satellite networks to play in supporting cost-effective, ubiquitous connectivity across rail networks. By leveraging the latest satellite-enabled technologies, rail operators will have the tools they need to monitor and collect data on a much broader set of parameters – from the real-time location of locomotives to the position of maintenance crews – all contributing towards improved network visibility and increased operational efficiencies.

It is important to note that not all satellite communications are the same. The demand for satellite connectivity is increasing all the time and new applications are constantly emerging, and because of this a range of satellite services are available that differ in their characteristics and qualities. A key topic of discussion is centered on Low Earth Orbit (LEO) satellites, and understanding how they compare with Geostationary (GEO) satellites is crucial to determining your approach.

LEO and MEO (Medium Earth Orbit) satellites both come under the veil of non-geostationary-orbit (NGSO) satellites. LEO satellites orbit at an altitude below 2,000km above mean sea level, while MEO satellites commonly orbit at 20,000km above the earth's surface but can orbit anywhere in the region between 2,000km-35,800km.

In contrast, geosynchronous earth orbit (GEO) satellites orbit at an altitude of approximately 35,800km above mean sea level.

Due to their lower altitudes, LEO and MEO satellites do not synchronise with the earth's rotation and orbit the earth more rapidly than GEO satellites. For a LEO satellite an orbital period takes roughly 128 minutes, whereas for MEO satellites it can take between 2-8 hours. This means that multiple LEO and MEO satellites are required in order create a constellation that can provide seamless coverage across the earth. Contrastingly, GEO satellites take one day to complete a single orbit, which means that it moves in line with the earth's rotation.

Although in principle GEO satellites have a higher latency (the speed it takes for messages to be relayed) than LEO satellites, the reality is actually more complex. For a LEO satellite constellation to achieve lower latency, the operator must have

a sufficient number of landing stations to collect the data back on earth, which then relays the message to its destination, in this case the train or trackside application. If the operator's nearest ground station is a long way from the destination, the latency experienced can be drastically higher.

Geostationary satellites have earned their name due to the fact that they appear in precisely the same point in the sky at any given moment. Because they are constantly in the field of view and their orbit is higher only three GEO satellites are needed to provide global coverage. This means that hardware is cheaper compared to LEO/MEO tracking antennas which require mechanical moving parts to track satellites, a secondary antenna ready to track the next satellite for seamless connectivity or expensive electronic components for non-mechanically steered antennas.

Further differences can be seen in their respective use cases. LEO satellites are commonly deployed for communications purposes and the transmission of scientific data, while MEO satellites cover a variety of uses including communications and navigation. In contrast, GEO satellites are primarily used for services including telecommunications and weather monitoring.

Satellites can also use a variety of radio and microwave frequencies, but international agreements aimed at minimising communications disorder restrict their operation to specific bands. The most popular service bands are L-band, Ka-band and Ku-band, while others include C-band and X-band which the latter is reserved for military use.

L-band uses frequencies in the 1 to 2GHz range, which means that these services are global and resilient to adverse weather conditions, so offer very reliable, but relatively low bandwidth communications. L-band is perfect for critical communications and telemetry services on locomotives, with Inmarsat's L-band BGAN services being used on thousands of locomotives globally.

In contrast, Ku-band uses frequencies in the 12 to 18 GHz range, and Ka-band uses frequencies in the 26.5 to 40 GHz range. With these higher frequencies you can extract more bandwidth, which means a higher data transfer rate and, therefore, higher performance. However, both are susceptible to rain fade or the absorption of radio frequency signals by atmospheric rain, snow, or ice, which means that coverage can sometimes drop. This is an important factor to consider when choosing communications for safety services, resiliency or remote operations.

CHOOSING THE RIGHT SATELLITE CONNECTIVITY PARTNER

It's clear that in terms of capabilities and suitability for specific use cases, understanding the differences and limitations of different satellite systems is crucial. Satellite operators offer a diverse set of services with some offering one type of constellation and service band, in a particular area, while others offer multi-band services with various constellations for different use cases. Ideally, rail operators should therefore be looking to partner with a satellite provider that offers a global multi-band service so that they have access to different speeds and capabilities that will ensure specific needs and circumstances are catered for.

Due to the unique nature of the requirements amongst rail operators, there are several key factors that also need to be at the forefront of considerations when selecting a satellite partner.

Network coverage
Network provide coverage to the whole of the track?

Reliability
How often will the service be online allowing critical communications?

Speed
Does the service provide the speed of data transfer you need?

Hardware
Is the hardware the right form factor to be mounted on a locomotive? How robust is it and will it withstand the harsh levels of vibration, heat and dust atop a locomotive?

Compatibility
Can the hardware integrate with other on-board systems with ease?

NETWORK COVERAGE

Firstly it is necessary to establish whether a satellite provider can provide coverage to the whole of your current rail network. Working with a satellite provider who does not have a satellite or series of satellites positioned over the entirety of your region is a non-starter. However, you should be mindful that as rail networks grow and multi-national services, agreements and standards proliferate, it will be beneficial to work with a provider who does not just cover your country but has coverage over a wide area and is involved in global standards. This will reduce potential complications and spend as rail networks and operators collaborate and converge.

SPEED

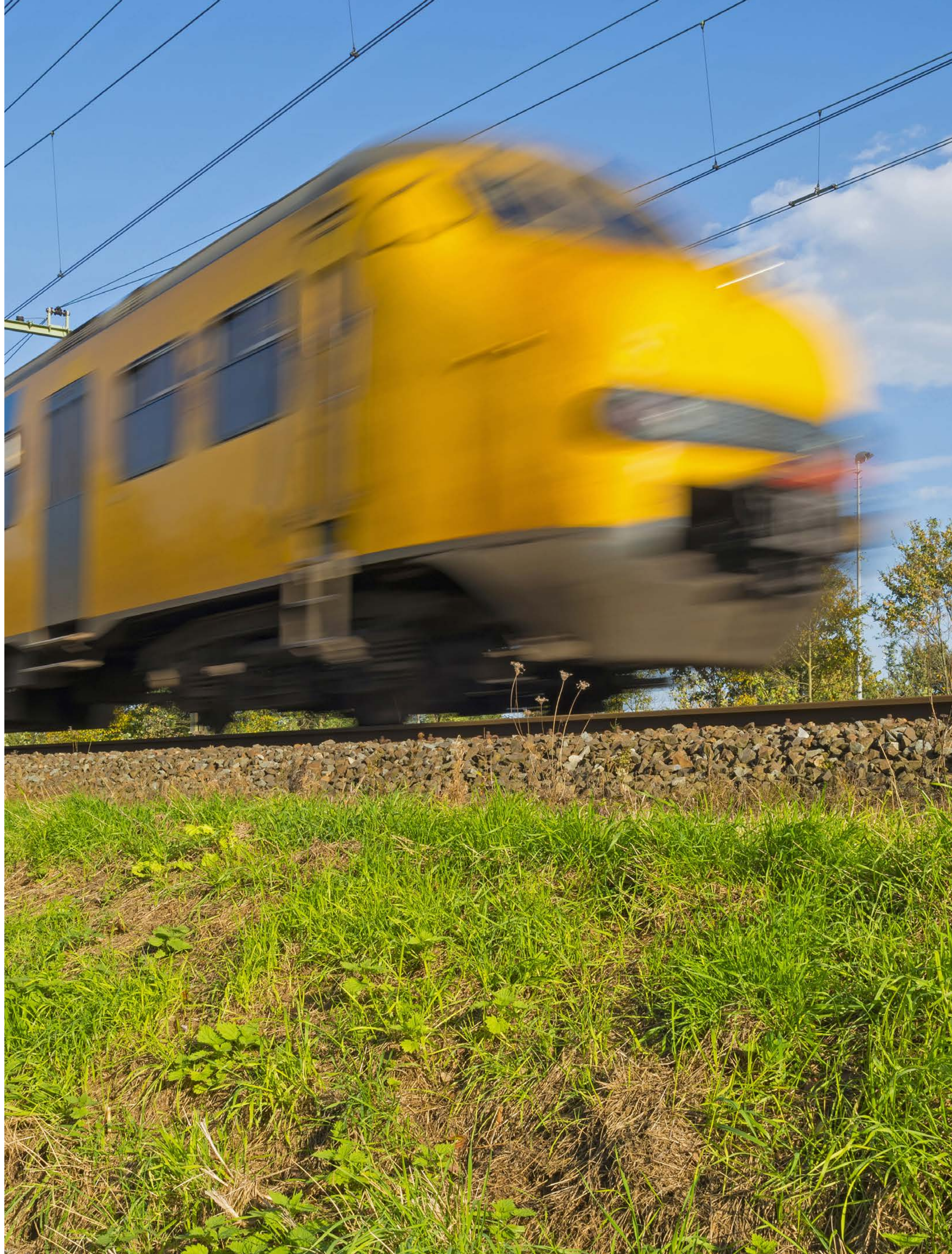
The key here is finding a provider who can deliver the right speeds for your use cases. A locomotive's telemetry and voice communications will not require the same speeds as a passenger who is looking to watch video content. There is little point in spending money on a service which allows fast speeds where a simpler service will save money. With mobile satellite communications there is also a trade-off between speed and the size and type of terminal used. Speeds, and correspondingly terminal size, can increase to where it becomes difficult to fit a single large terminal on a train, with it becoming necessary to fit multiple smaller terminals to meet bandwidth and speed needs.

RELIABILITY

The level of reliability a satellite provider provides is paramount. It doesn't matter if they theoretically have coverage over an area if there isn't a connection between your locomotive and the satellite. LEO satellites do not synchronise with the earth's rotation and cannot always be 'seen' by terrestrial user terminals. Because of this connectivity can periodically fail, making it poorly suited to mobile use cases where data needs to be constantly collected. Each LEO satellite manages the terminal handover to the next satellite as it exits from view, and if there is no available capacity on the next satellite then connectivity will fail.

Capacity is also restricted on some LEO constellations around the world due to interference with scientific radio astronomy installations, resulting in less channels being available, less power provided to close satellite links, and in the worst cases, dark spots over those regions.

In contrast, because GEO satellites move in line with the earth's rotation, they are ideal for mobile use cases, including tracking the position of locomotives and maintenance crews in real-time. Inmarsat owns and operates 13 satellites in geostationary orbit, which together can support the ubiquitous connectivity across global rail networks needed for both static and mobile use cases.



HARDWARE

Developments in satellite communications now mean that satellite networks usually require just a terminal to be set up on locomotives or other assets for them to be connected. However, due to the nature of rail operations it is imperative that any hardware is able to withstand bad weather or the effects of harsh environments such as dust ingress.

For example, the Cobham EXPLORER 323 is a highly durable, low form factor terminal that has an integrated antenna and receiver, meaning only a rooftop unit is needed and there are no moving parts. This means that it is ideally designed for mounting on locomotives operating in the harshest environments, offering rail operators the mobility and reliability they need.

A PROVEN TRACK RECORD

Above all, it is absolutely vital to work with a satellite connectivity partner with a proven track record of success in the industry, and one that has a committed to a future roadmap for maintaining their network with a sustainable business model. The last thing any rail operator wants to do is invest in satellite infrastructure that subsequently becomes redundant.

USE CASES FOR SATELLITE CONNECTIVITY

CONNECTIVITY ON LOCOMOTIVES

RAIL TELEMETRY AND COMMUNICATIONS SOLUTION

Inmarsat's Rail Telemetry and Communications Solution enables the real-time transfer of telemetry data from locomotives to the control centre, as well as the ability to extend voice coverage for drivers and staff beyond the range of existing radio networks. Utilising our satellite-enabled BGAN the solution provides highly reliable connectivity across the network, covering dark spots in terrestrial coverage as well as providing a reliable backup if existing networks fail. This ensures telemetry data points such as location, speed, heading and engine diagnostics are always available to the control centre operator.

Typically, the connectivity is integrated and optimised with other on-board systems such as train control, signalling or diagnostic applications.

The solution utilises low form factor terminals, such as the Cobham EXPLORER 323 mentioned earlier. This hardware has no moving parts, with an electronically steered antenna which makes for greater reliability in harsh environments, where issues such as dust ingress are common.

The BGAN terminals are linked to the PRISM Push-to-Talk (PTT) radio communications system to extend the reach of existing radios. PRISM PTT is a smart system that has the capability to employ a least-cost routing approach to switch between the cheapest and most stable connectivity link, be it UHF, VHF, 3G/4G and satellite. This extends coverage beyond the line of sight and ensures you are able to access the most cost-effective connectivity channel to communicate through. In addition to real-time data on location, the solution also enables visibility of engine status and the direction in which the locomotive is heading, creating a full picture of situations faced by crews in real-time.

The results already speak for themselves when it comes to the use of these new satellite technologies, with the Explorer 323 terminal and the PRISM PTT radio system operating across Inmarsat's BGAN satellite network and featuring in a number of case studies. Operators such as Rumo Rail in Brazil, for example, are rapidly benefitting from this technology, with increasingly safe, efficient operations being seen across its network.

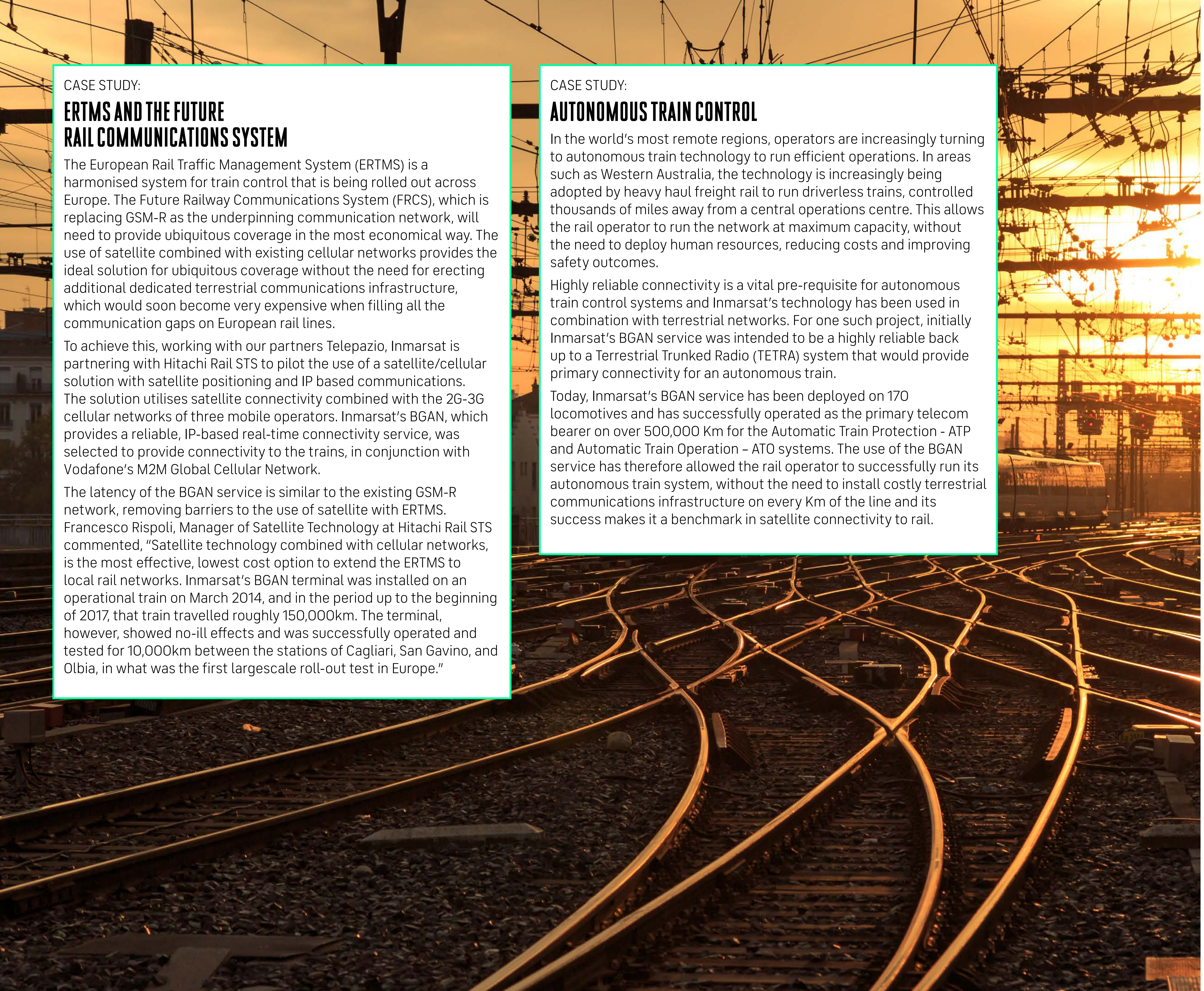
CASE STUDY:

RUMO RAIL

Rumo Rail is responsible for managing 14,000km of railway track in Brazil. As most of its network passed through remote areas with unreliable or non-existent network coverage, train drivers, railway engineers and transport managers had no way of communicating effectively.

Through our partner Globalsat Group, 300 of Rumo's cargo trains were equipped with Cobham EXPLORER 325 BGAN terminals, EXPLORER Mobile Gateways and the PRISM PTT+ service.

This solution has enabled the accurate real-time tracking of each train as well as reliable voice and data communication between drivers, maintenance crews and regional control centres. The connectivity improvements being brought by mobile satellite communications have improved Rumo's operations, making rail a more reliable and effective transport proposition that the Brazilian economy can depend on.



CASE STUDY:

ERTMS AND THE FUTURE RAIL COMMUNICATIONS SYSTEM

The European Rail Traffic Management System (ERTMS) is a harmonised system for train control that is being rolled out across Europe. The Future Railway Communications System (FRCS), which is replacing GSM-R as the underpinning communication network, will need to provide ubiquitous coverage in the most economical way. The use of satellite combined with existing cellular networks provides the ideal solution for ubiquitous coverage without the need for erecting additional dedicated terrestrial communications infrastructure, which would soon become very expensive when filling all the communication gaps on European rail lines.

To achieve this, working with our partners Telepazio, Inmarsat is partnering with Hitachi Rail STS to pilot the use of a satellite/cellular solution with satellite positioning and IP based communications. The solution utilises satellite connectivity combined with the 2G-3G cellular networks of three mobile operators. Inmarsat's BGAN, which provides a reliable, IP-based real-time connectivity service, was selected to provide connectivity to the trains, in conjunction with Vodafone's M2M Global Cellular Network.

The latency of the BGAN service is similar to the existing GSM-R network, removing barriers to the use of satellite with ERTMS. Francesco Rispoli, Manager of Satellite Technology at Hitachi Rail STS commented, "Satellite technology combined with cellular networks, is the most effective, lowest cost option to extend the ERTMS to local rail networks. Inmarsat's BGAN terminal was installed on an operational train on March 2014, and in the period up to the beginning of 2017, that train travelled roughly 150,000km. The terminal, however, showed no-ill effects and was successfully operated and tested for 10,000km between the stations of Cagliari, San Gavino, and Olbia, in what was the first largescale roll-out test in Europe."

CASE STUDY:

AUTONOMOUS TRAIN CONTROL

In the world's most remote regions, operators are increasingly turning to autonomous train technology to run efficient operations. In areas such as Western Australia, the technology is increasingly being adopted by heavy haul freight rail to run driverless trains, controlled thousands of miles away from a central operations centre. This allows the rail operator to run the network at maximum capacity, without the need to deploy human resources, reducing costs and improving safety outcomes.

Highly reliable connectivity is a vital pre-requisite for autonomous train control systems and Inmarsat's technology has been used in combination with terrestrial networks. For one such project, initially Inmarsat's BGAN service was intended to be a highly reliable back up to a Terrestrial Trunked Radio (TETRA) system that would provide primary connectivity for an autonomous train.

Today, Inmarsat's BGAN service has been deployed on 170 locomotives and has successfully operated as the primary telecom bearer on over 500,000 Km for the Automatic Train Protection - ATP and Automatic Train Operation – ATO systems. The use of the BGAN service has therefore allowed the rail operator to successfully run its autonomous train system, without the need to install costly terrestrial communications infrastructure on every Km of the line and its success makes it a benchmark in satellite connectivity to rail.

SATELLITE RAIL SIGNALLING

Next generation signalling systems are increasingly being deployed by rail operators to increase capacity, improve safety and reliability. Increasingly, rail operators are relying less on traditional fixed block signalling equipment and are moving to more dynamic moving block signalling systems in order to increase capacity on existing track. As these systems evolve, the trend is heading towards delivering signalling and communications straight to the train cab wherever it might be, even moving to fully autonomous train control solutions. All of this relies on having completely reliable connectivity from operations centre to train that you can be sure will not fail.

Whilst terrestrial connectivity is the primary communications method, satellite has a major role to play in filling gaps in coverage and also providing a highly reliable back-up should the terrestrial network fail. As 5G networks are being rolled out the world over, satellite has a clear role to play in the mix of connectivity options to achieve ubiquitous coverage.

Inmarsat's highly reliable L-band network that operates with 99.9% satellite availability is providing rail operators with the ability to implement next generation signalling systems across their networks, today. With low latency periods that match the capability of cellular communications, satellite opens up the possibility of deploying next generation signalling systems in hard to reach areas. For deployments of communication networks that can truly provide ubiquitous connectivity, satellite should interoperate with existing terrestrial connectivity to provide a low cost, multi bearer approach which utilises the cheapest stable connection.

CONNECTIVITY ON OTHER ASSETS

MAINTENANCE CREW CONNECTIVITY

A further challenge is ensuring the constant communication between control centres and maintenance crews operating remotely along the rail network.

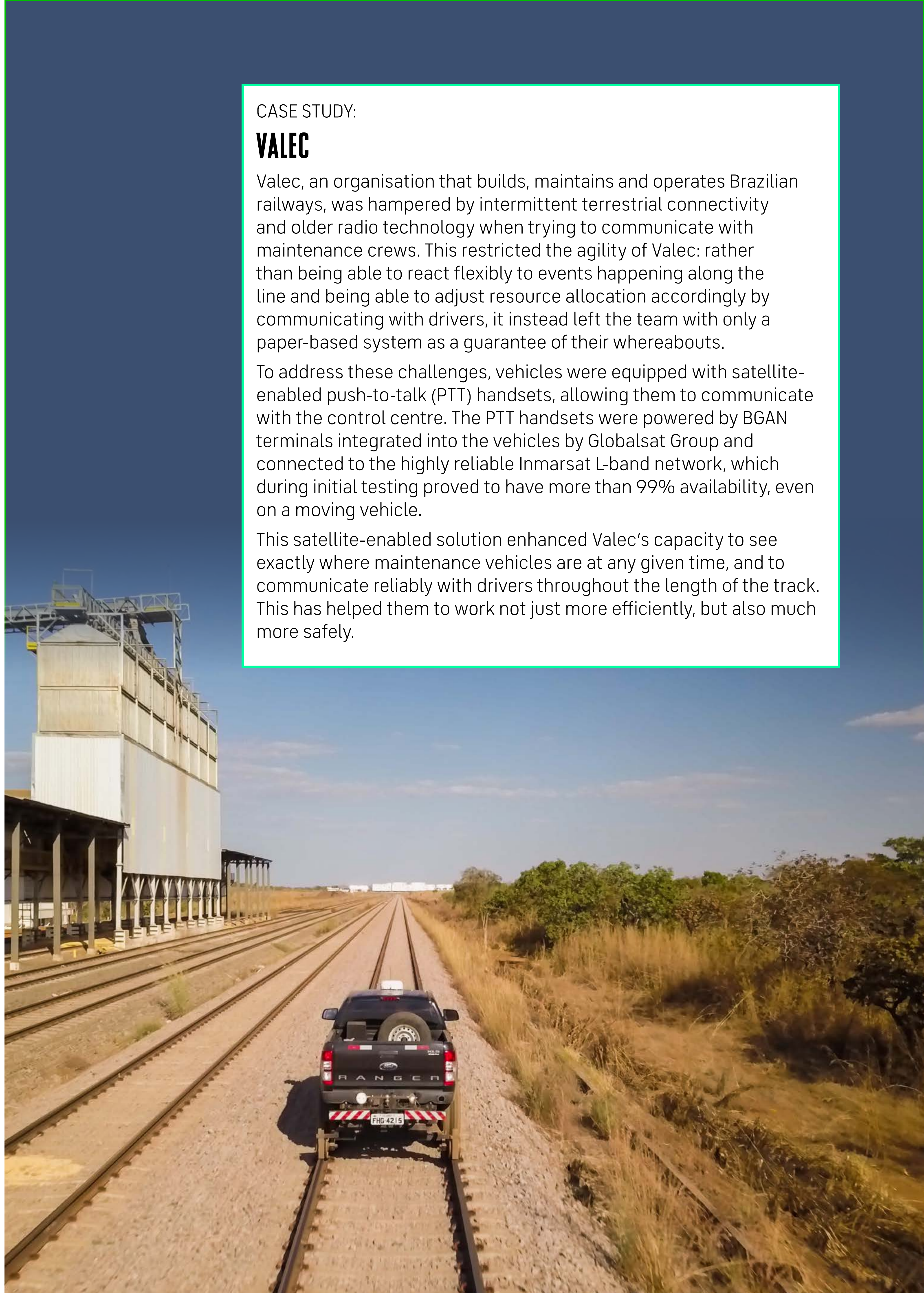
Considering the sheer distances involved and the scale of the work at hand, having reliable and constant communication between maintenance crews, trains and control centres is key. If control centres are unable to communicate with maintenance crews in real-time, this not only presents rail companies with potential safety concerns, but also hinders their ability to ensure maintenance issues on the network are being addressed efficiently and downtime kept to a minimum.

Satellite is a cost-effective method to ensure maintenance crews can keep connected, wherever they are located. Without the use of satellite, maintenance crews must rely on publicly available terrestrial networks which may mean the nearest reliable signal is miles away from the point at which the crew is working. Depending on the needs of the crew, satellite solutions could include:

- Handheld satellite phones, which operate in the same way as a regular cellphone, but provide voice connectivity anywhere, for example Inmarsat's IsatPhone2
- Portable Wi-Fi hotspots over satellite using a fully portable terminal which integrates with a phone, tablet or laptop to allow crews to talk, text and access the internet independently of cellular and fixed networks. Inmarsat's BGAN service provides this functionality and is controlled via an easy to use app which makes it quick and easy for crews to establish connectivity for critical voice and internet applications.
- Equipping maintenance vehicles with a mobile satellite terminal to provide internet access and voice over IP (see below).

Inmarsat and its partners have provided connectivity solutions to maintenance crews featuring rugged, low form factor terminals, such as the Cobham EXPLORER 323, combined with a satellite-enabled push-to-talk (PTT) handset system that links to the terminal to provide voice communication. The solution enables maintenance crews to stay in constant contact with central base command and operations centres wherever they are.

These latest innovations in satellite-enabled maintenance crew connectivity ensure that all the necessary data on maintenance crew vehicles, such as their location and their current job status, is being constantly fed through to the operations centre. This means that if there is an issue on the network the operator instantly knows which available crew is closest, and is able to fix the issue as quickly and efficiently as possible.



CASE STUDY:

VALEC

Valec, an organisation that builds, maintains and operates Brazilian railways, was hampered by intermittent terrestrial connectivity and older radio technology when trying to communicate with maintenance crews. This restricted the agility of Valec: rather than being able to react flexibly to events happening along the line and being able to adjust resource allocation accordingly by communicating with drivers, it instead left the team with only a paper-based system as a guarantee of their whereabouts.

To address these challenges, vehicles were equipped with satellite-enabled push-to-talk (PTT) handsets, allowing them to communicate with the control centre. The PTT handsets were powered by BGAN terminals integrated into the vehicles by Globalsat Group and connected to the highly reliable Inmarsat L-band network, which during initial testing proved to have more than 99% availability, even on a moving vehicle.

This satellite-enabled solution enhanced Valec's capacity to see exactly where maintenance vehicles are at any given time, and to communicate reliably with drivers throughout the length of the track. This has helped them to work not just more efficiently, but also much more safely.

WAGON AND CARGO MONITORING

Many rail operators have huge inventories of rolling stock including locomotives and wagons, and understanding the location and status of these assets lays a foundation for improving efficiencies and reducing costs. Depending on the specific technology employed, real-time monitoring of wagons can amongst other outcomes reduce theft, enable predictive and targeted maintenance, or allow real-time condition monitoring of goods in transit.

Ubiquitous connectivity is a vital pre-requisite to successfully achieving this, with wagons often being stored or moved through remote locations where cellular communications are unreliable. The type of communications infrastructure deployed will depend on the exact use case and the location of the wagon when monitoring is required. For example, if the challenge is to monitor wagons in transit when attached to specific locomotives, monitoring may be achieved through the use of a long range network, with data from multiple wagons aggregated and sent via satellite from a single point, or in this case a satellite terminal. If the wagons to be monitored will need to connect independently from each other, then a satellite terminal can be mounted on each asset independently.

Inmarsat's satellite-enabled Wagon and Cargo Monitoring Solution provides rail companies with flexible, real-time monitoring of their assets out in the field, no matter where they are located. By using Inmarsat's L-band IsatData Pro (IDP) service, rail companies are able to track and monitor fixed or mobile assets globally and measure the exact conditions encountered by a wagon in real-time. This is particularly useful if you have a shipment of food, for example, which requires the operator to closely monitor the temperature and humidity of a consignment in a particular wagon in order to prevent waste or damage. It is also a vitally important security measure to combat theft, providing the operator with constant visibility across all wagons carrying high-value goods.

Inmarsat's IDP service is a proven, highly reliable and high-performance two-way messaging service that works consistently worldwide using a single device, enabling rail companies to use a wide range of asset tracking applications across their rail networks.
The terminal has a low power consumption that makes it perfect for use on assets in remote locations, and ensures data transfer on the move if required.

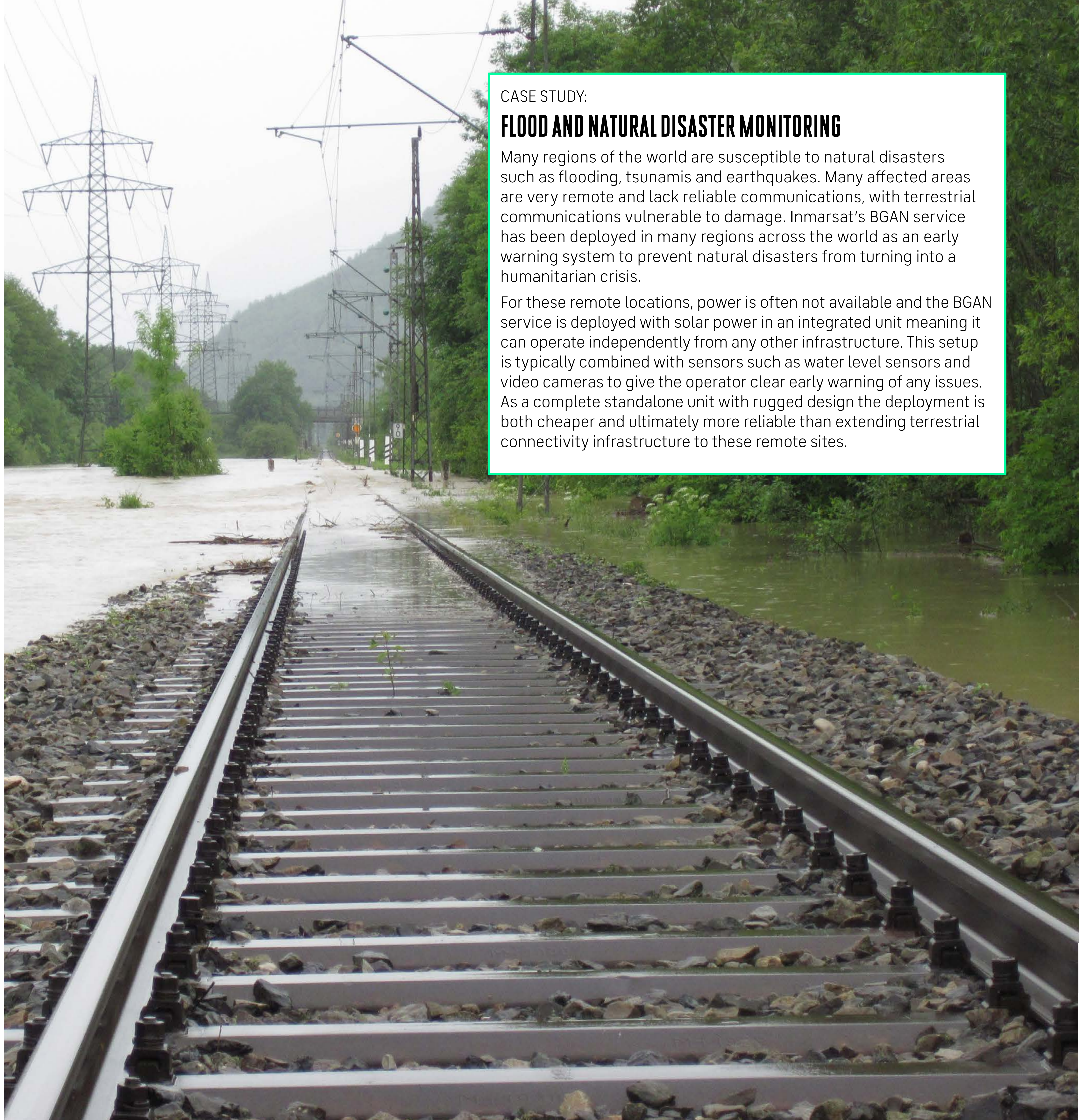
TRACKSIDE ENVIRONMENT MONITORING

Railway tracks, particularly those in remote areas, can be prone to damage from natural disasters such as flooding or landslides. If left unchecked, such disasters can cause accidents with dire repercussions for worker and passenger safety, as well as extended downtime that can lead to reduced profitability. After a weather event has occurred, it is crucial to understand whether parts of a rail network have been affected.

Areas which are particularly susceptible to the effects of a weather event need to be constantly monitored. Often the remote nature of these locations means that terrestrial connectivity is unreliable, and the cost of installing private terrestrial networks prohibitive. Ultimately this means that checks are often carried out manually, with inspections being infrequent and a significant drain on time and resource due to travel.

Satellite connectivity combined with the latest sensor technology such as piezometers or water level sensors provides a cost effective alternative for monitoring track in remote locations. For example, Inmarsat's Trackside Environmental Monitoring Solution utilises Inmarsat's L-band IDP or BGAN services, enabling rail companies to monitor weather-susceptible remote rail environments in real-time. Because the terminals used have a low power consumption, they are well suited for use in remote environments where power is an issue and can run off an integrated solar powered solution.

Inmarsat can integrate and work with a wide range of sensors, connecting them via Long Range Wide Area Network (LoRaWAN) to an Intelligent Edge Gateway, which aggregates data before it is sent back via L-band satellite connectivity to any choice of application. This allows rail companies to remotely monitor sidings and hillsides for slippage and landslides which may impact the rail track in remote locations without cellular or terrestrial connectivity, anywhere in the world. Crucially, the insights that are produced can inform quicker responses and better decisions, helping rail operators to run a much safer, smarter, and a more efficient network.



CASE STUDY:

FLOOD AND NATURAL DISASTER MONITORING

Many regions of the world are susceptible to natural disasters such as flooding, tsunamis and earthquakes. Many affected areas are very remote and lack reliable communications, with terrestrial communications vulnerable to damage. Inmarsat's BGAN service has been deployed in many regions across the world as an early warning system to prevent natural disasters from turning into a humanitarian crisis.

For these remote locations, power is often not available and the BGAN service is deployed with solar power in an integrated unit meaning it can operate independently from any other infrastructure. This setup is typically combined with sensors such as water level sensors and video cameras to give the operator clear early warning of any issues. As a complete standalone unit with rugged design the deployment is both cheaper and ultimately more reliable than extending terrestrial connectivity infrastructure to these remote sites.

TRACKSIDE INFRASTRUCTURE MONITORING

When managing a network over thousands of kilometres, a challenge for many rail companies is managing infrastructure, including unmanned level crossings which are located in remote locations and often beyond the reach of terrestrial networks and power access.

By utilising Inmarsat's L-band IDP or BGAN network, rail companies are able to monitor infrastructure in remote areas of their network in real-time. By connecting sensors via LoRaWAN to an Intelligent Edge Gateway, data can be sent back via L-band satellite network to any choice of application. In turn, this can boost the levels of connectivity at unmanned level crossings, allowing a central command centre to effectively monitor and operate them automatically or to detect any potential issues remotely.

PASSENGER CONNECTIVITY

Finally, in addition to the maintenance of track, environment and rolling stock across the network, the need for faster staff and passenger connectivity in remote areas is only going to increase in importance in the future. The latest developments in satellite connectivity solutions for the rail industry continue to look at new, more cost-effective ways of providing a rich internet experience for passengers in those remote areas where such connectivity was previously unavailable.

A FUTURE OF UBIQUITOUS CONNECTIVITY TO TRAINS AND THE RAILROAD?

As the use cases outlined above make clear, satellite networks form a core part of the overall connectivity mix, alongside radio, cellular and fibre networks, that rail organisations need to access ubiquitous connectivity and ensure the constant transfer of data from their assets to central control centres.

With satellite-enabled solutions now being a far more robust and cost-effective option, the global rail industry is closer to reaching the 'holy grail' it has been seeking for many years: always-on ubiquitous connectivity that facilitates greater network efficiency, increased profitability, enhanced safety and improved environmental performance. As the advent of new networks such as 5G are being rolled out, satellite has a huge part to play to augment the network, filling dark spots in coverage without the need to deploy costly terrestrial infrastructure. When viewed together, all of this will benefit the wider economy and global supply chains.

ABOUT INMARSAT

Inmarsat is the global market leader in mobile satellite communications with an unrivalled heritage of over 40 years' experience in supplying satellite services. We also have a long history in the rail sector, with key landmark clients in freight rail and network maintenance organisations. Our satellite connectivity is currently being used on over 2,000 locomotives worldwide and in some of the most remote regions in the world where natural environments present harsh conditions. This proven track record and heritage puts us in an excellent position to serve the rail industry globally.

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