

& Telematics

PRESSURE MONITORING

by Intermodal Telematics

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CRYOGENICS
by **TRIFLEET**



Edwin Wullems
Trifleet's Maintenance &
Repair Manager Cryo

Trifleet Leasing
(the Netherlands) B.V.

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Eric de Groot & Matthijs Rosman

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FINDING OPPORTUNITIES

in a new world



INTERVIEW ERIC DE GROOT AND MATTHIJS ROSMAN

The world is a different place. We live in times of unprecedented change. In many perspectives we find ourselves in uncharted territory, where nothing is what it seems, and no one knows where we are going. In the science of anthropology, this state is called 'liminality'. Liminality is defined as the quality of ambiguity or disorientation that occurs in the middle stage of a significant change of the status of society.

We are in an 'in-between' period, between a structured world view of the past and the unknown of the future. We are tested in our ability to cope and adapt, and are experiencing a sort of reset. A reset that offers a great opportunity. It allows us to take a new look at who we are, what we want, and who we can be.

COVID-19 is turning out to be a great disruptor. We believe in the mantra 'never waste a good crisis'. Companies that are willing to take advantage of this reset will come out on top.

Innovate to stay relevant

Innovative growth is the only way to stay relevant in this digital age. It is not a question of 'should I innovate?' but rather 'how?' and 'where?'. The threat of being disrupted lies just around the corner for every industry and its leaders. Companies are no longer built to last forever.

The concept of 'too big to fail' is more a motivator for disruptors than a license for complacency for the incumbent. The average company lifetime is declining rapidly towards decades rather than centuries. Past performance is no longer a guarantee for the future.

Finding opportunities in a new world

Urgency and excitement

Innovation is all about 'change'. Organizations don't change, people change. However, the reality is that nobody really likes to change. In change literature two sources of change are described. A sense of urgency, the extrinsic motivator, and a sense of excitement, the more intrinsic motivator. The latter is often embodied in an inspiring leader/entrepreneur and or shared vision or purpose.

We have found that people hardly change when they 'see the light.' People only change when they 'feel the heat.' When competition rises and a need for change becomes inevitable for survival. Unfortunately, this is often too late. What is hard about change is overcoming the reluctance of leaving behind what has worked well for us in the past.

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Knowing where to innovate is as important as knowing how to innovate. Innovations come from the minds of people.

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Change initially always brings discomfort. However, it is far better to feel uneasy than to become extinct. These are times of disruptive change and radical obsolescence. The digital age brings a completely new ball game, and it is played in fast-forward mode. Or, in other words, what you are doing today may be without value and meaning tomorrow.

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To keep up with the world of 2050, you will need to do more than merely invent new ideas and products, but above all, reinvent yourself again and again

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Yuval Noah Harari

Where to start, the DARE mindset

Knowing where to innovate is as important as knowing how to innovate. Innovations come from the minds of people. To be successful in innovation you must have the proper mindset. Nothing beats the human mind. Only the human mind can make those rare connections between almost randomly retrieved pieces of stored information in our brains.

To make innovation work for you and your company you must have the right mindset. We call this mindset 'DARE'. It comprises four key elements: defiance, adventure, realism, and endurance. The first two deal with the creative (and sometimes destructive) part of innovation: the search for, and experimentation with, new ideas and business ventures. The second part, comprising realism and endurance, is the executional part of innovation. It is often the hardest part and is concerned with the hard grind of making innovation happen and keeping it sustainable.



Creativity and Execution

DARE starts with having the courage to do something. To defy and challenge. To provoke and be bold in breaking down the governing myths and beliefs in organizations and industries. It is a rebellious mindset that challenges the status quo; one that realizes that transformation can only occur when we don't simply think 'outside of the box' but discard the box altogether. Observation is a powerful tool for defiance. Observe, yet do not follow, the leaders in your industry and beyond. Try the opposite.

Defiance is followed by disruptive creativity and 'failing forward' – a startup term for discovery. It is about having an adventurous mindset. Being curious. Constantly looking for the 'new, new' and being in a state of 'perpetual beta.' The DARE mindset embraces adventure, like Peter Pan in Neverland.

In 1942, the Austrian Joseph Schumpeter introduced the concept of 'creative destruction,'

the notion that innovation would disrupt the current economic order. He developed the theory of 'Neue Kombinationen' - connecting seemingly unrelated existing concepts to create something entirely new. Connecting random dots is a powerful human brain characteristic of creativity.

Experimental learning is the path of the adventurer. Having an adventurous mindset also implies being comfortable with the unknown; venturing out on a path from A to B, where B is not yet known. Where B is an emerging destination, which reveals itself when we allow ourselves to embark on an adventure.

Innovative growth becomes sustainable when the outcome of adventure is paired to a sense of realism; when fiction and adventure become fact. No business can exist on the merits of fantasy alone. Peter Pan needs to cross swords with the Grey Wizard. Or, in the

Finding opportunities in a new world

present day, the data scientist: the one that wields the weapon of truth, who demystifies and objectifies.

In our book DARE, we stress the importance of reliable data in modern day decision making. The fact is that gut feeling is not the best algorithm in the world. We must let go of the idea that we – humans, experienced managers – have the wisdom to know it all. We are full of biases impacting our decision making. Even worse, past experiences are, in our dynamic and highly changing society, bad counselors. We have more and more data to come to our aid in making swifter and better decisions. Realism also entails that we must make money with our innovations – a viable business case – in order for innovation to be sustainable.

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In our book DARE, we stress the importance of reliable data in modern day decision making. ”

In many organizations, the largest impediment to realizing growth from innovation stems from a lack of endurance. Endurance refers to ‘disciplined execution’. It refers to grinding down to the very end; to making things happen. Along the way, the treacherous ‘valley of tears’ and ‘troughs of disillusionment’ have to be navigated. Execution is often deemed inferior to strategy.

Do not forget that innovation equals execution and execution equals innovation. As is often said, strategy without execution is hallucination. Endurance is about sticking to your commitments, even when the pay-off is not immediately apparent. In the end, achieving innovative growth is down and dirty hard work.

Eric de Groot & Matthijs Rosman



Eric and Matthijs are both partners at RevelX, a boutique professional services firm specialized in innovation and digital transformation, based in Amsterdam, the Netherlands.



They are the authors of DARE, the Mindset of Successful Innovators in the Digital Age, an Amazon bestseller in the USA.

More info: <http://revelx.co>

Team effort

Innovation is not an individual exercise. It is the collective achievement of several people. These people might be working separately and sequentially, or in parallel, on the same solution for years. They work individually, in teams, in organizations, and in ecosystems.

Big bet innovations are often seen as the achievement of a single great mind, but these icons have seldom acted alone. The same applies when it comes to DARE. We know only a few people who embody all aspects of the DARE mindset. Teams, on the other hand, can be deliberately forged around the four key characteristics.

DARE to grow

Realizing growth is one of the hardest tasks in any organization. Realizing innovative and sustainable

Finding opportunities in a new world

growth is even harder. We see evidence of this all around us. Startups often fail to scale. Many companies fail to leverage innovation as a source of growth. The very existence of these businesses is at stake if they are not able to turn the situation around. If you really want to grow and innovate you need resistance. Whether that is a shortage of money or competence or a social and or economic crises, just to name a few. Disruption is no longer a faint possibility; it is as real as can be. Do nothing – or, even worse, be complacent about it – and your chances of survival are slim.

Our research in innovation readiness clearly exposes two major issues inhibiting innovative growth. The first pertains to having the right mindset and skills. The second can be seen as the outcome of the first; a lack of speed and agility in materializing innovation to drive competitive advantage.

Innovation Readiness survey

If you want to know if you are ready to drive growth with innovation effectively, please feel free to participate in our Innovation Readiness survey

(<https://www.revelx.co/innovation-readiness-scan/>).

Within 48 hours you will receive your free report where we compare your company against 35 best practices that define the readiness of your company for future growth.

Let's innovate!



About the book

DARE

We live in times of autocatalytic change in which realizing growth is one of the hardest tasks. A growing graveyard of startups and corporate ventures is just the tip of the iceberg.

Innovation is no longer an option; it is a license for future survival. Research indicates more than 6 out of 10 corporate executives evaluate their innovation activities and capabilities as inadequate. Root cause: a missing innovative mindset and way of working.

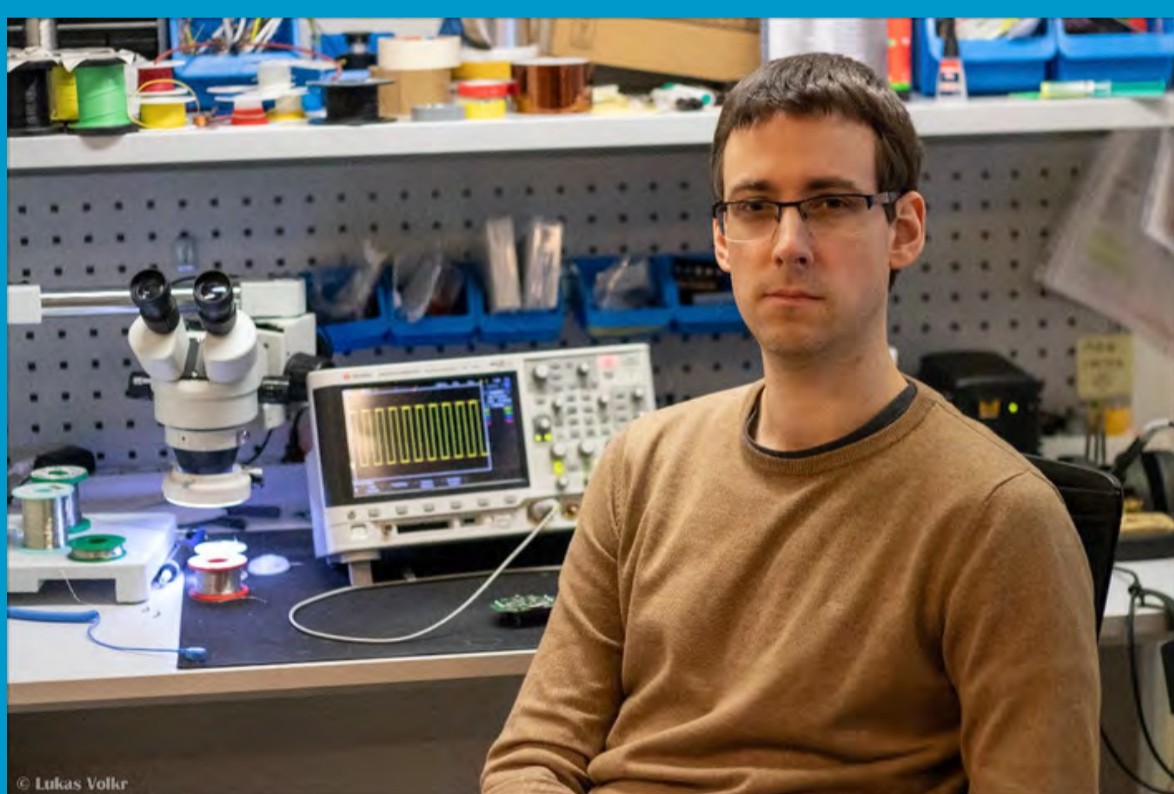
DARE is about innovation and innovators. It provides a human centric approach to innovation. Reading DARE gives insight in its most critical component: mindset. Many innovators get lured into the maze of frameworks and methodologies. Only few succeed in instilling a mindset of innovative growth in their organizations.

By reading DARE, you will benefit from over 50 years of experience in helping more than 200 organizations around the globe achieving ambitious growth goals. DARE is written from first-hand experience. DARE to grow!

Available as Paperback and Hardcover.



THE IMPORTANCE OF MONITORING PRESSURE



TAMÁS SZABÓ
Senior Electronics Engineer (IMT)

Monitoring the pressure is important to provide safe operation of the tanks and to protect the assets, people and the environment. The PS20-Ex is a wireless pressure sensor, monitoring tank pressure levels of intermodal tank containers and other pressure vessels, that is unique in the market as it provides continuous and real time data with configurable alarms.

The PS20-Ex blends the reliability of industrial pressure transmitters with the mobility of IoT. We started this project with the purpose of adding wireless capabilities to industrial pressure transmitters.

The PS20-Ex is the successor of the earlier PS18-Ex. The difference between these two sensors is their ATEX certification, the PS18-Ex is allowed to be placed in ATEX zones with IIB gasses, while the PS20-Ex improves on this and allows the sensors to be placed in IIC zones. This means that the sensor can be installed in zones with the most demanding gasses, like Hydrogen or Acetylene.



The importance of monitoring pressure

Customers have been using the PS18-Ex for the past three years, and it has been operated in the harshest of conditions. With the predicted battery life of ten years, Tank container operators can deploy the sensor without worrying about maintenance, charging, or battery replacement.

The new PS20-Ex allows an even larger battery pack, which would allow the same battery life with more demanding pressure transmitters, or extended battery life with standard sensors. The PS20-Ex is also using innovative power saving techniques to extend the battery life of the system.

The measurement time is reduced by using high speed accurate data converters, and the measurement accuracy is guaranteed with precision thin film resistors, that have reduced temperature effects, compared to the traditionally used wirewound resistors in industrial current loops.

The PS20-Ex also has a proprietary current limiting technique, that will ensure the safety of the system in case of a wiring fault, and does this without reducing the voltage output for the transmitters.

IMT is prepared to select a pressure transmitter that fits your application, to provide you with turnkey solutions. We can offer a solution with a sensor that can be fitted with sixteen different mechanical process connections, and it can be configured to over fifty different pressure ranges to cover all possible scenarios on any tank.

Alternatively, the PS20-Ex can be retrofitted to existing installations, or when the pressure transmitter is already selected. The PS20's software configurability allows to produce sensors to the exact need of the customer, and to support a wide variety of transmitters.

Pressure sensor PS20-Ex



The built in memory in the sensor allows the storage of measured values for more than a year. On bad GSM network conditions or long shipping routes, the data is buffered and automatically transmitted to our server and available on our web application, when a network is found.

Our web application can be configured to show the measured pressure values in your selected units of measurement. Configurable alarms allow us to alert our customers of dangerous pressure levels long before they happen. LNG boil-off is a real world example where the PS20-Ex is able to predict the boil-off before it happens, and preventive measures can be taken, so expensive and environmentally dangerous clean-up can be avoided.

While the PS20-Ex doesn't have an LCD readout, it can be connected to our wireless display. With the short range wireless connection, the installation of the two devices can happen anywhere on the tank, while all the readout instruments can be located at the same location. The wireless display also has ten years of battery life.



TELEMATICS AS A KEY FACTOR

TRIFLEET
LEASING EXCELLENCE

TELEMATICS CASE STUDY



Enabling the customer to monitor the key physical parameters of (hazardous) cargo by state-of-the-art sensors and telemetry that provides reassurance to shippers.



**Edwin Wullems, Trifleet's
Maintenance & Repair Manager Cryo**
Trifleet Leasing (the Netherlands) B.U.

Leading tank container lessor, Trifleet Leasing, continues to innovate and raise customer service levels by leveraging IMT's unique sensor-driven telematics capabilities. These are being deployed throughout its logistics processes and fleet, with telemetry offering a new added value service for its T75 cryogenic fleet.

Trifleet Leasing, one of the world's leading tank container leasing companies, has for some time identified telematics as a way to mitigate the inherent risk of transporting products while creating a new benchmark for customer service. Enabling the customer to monitor the key physical parameters of (hazardous) cargo by state-of-the-art sensors and telemetry that provides reassurance to shippers (or 'consignors') and highlights when and where dangerous thresholds may be exceeded, triggering pre-set alerts that enable timely interventions.

The ability to closely monitor pressure, for example, is particularly valuable in Trifleet's T75 cryogenic fleet, where IMT's specialist CS20 Cryogenic Solution uses two IMT pressure sensors to measure the tank container's liquid phase and gas phase pressures. The differential pressure between the two measurements directly corresponds to the fill level of the tank container, and the weight of the liquified cargo can be easily calculated if the physical properties of the liquid and tank container are known.

Rapid increase of the gas pressure inside a cryogenic tank container causes the overpressure valve to open. However, pressure monitoring by IMT's sensors can detect this pressure escalation, generating an early warning alert as an important safety message.

Edwin Wullems, Trifleet's Maintenance & Repair Manager Cryo, says that access to this operational information completely aligns with Trifleet's 'Safety first' company priority. "Keeping our fleet in top condition helps ensure the safety of all those involved and helps protect the environment - we take the extra steps needed to provide the quality needed and the Trifleet team is committed to sustainable excellence. The use of IMT's telematics to monitor several physical parameters is certainly a key factor in adding value to our promise of safety. Customers can use the innovative technology to monitor the product conditions throughout the time they lease our equipment and can set their own alert thresholds to give themselves time to intervene."

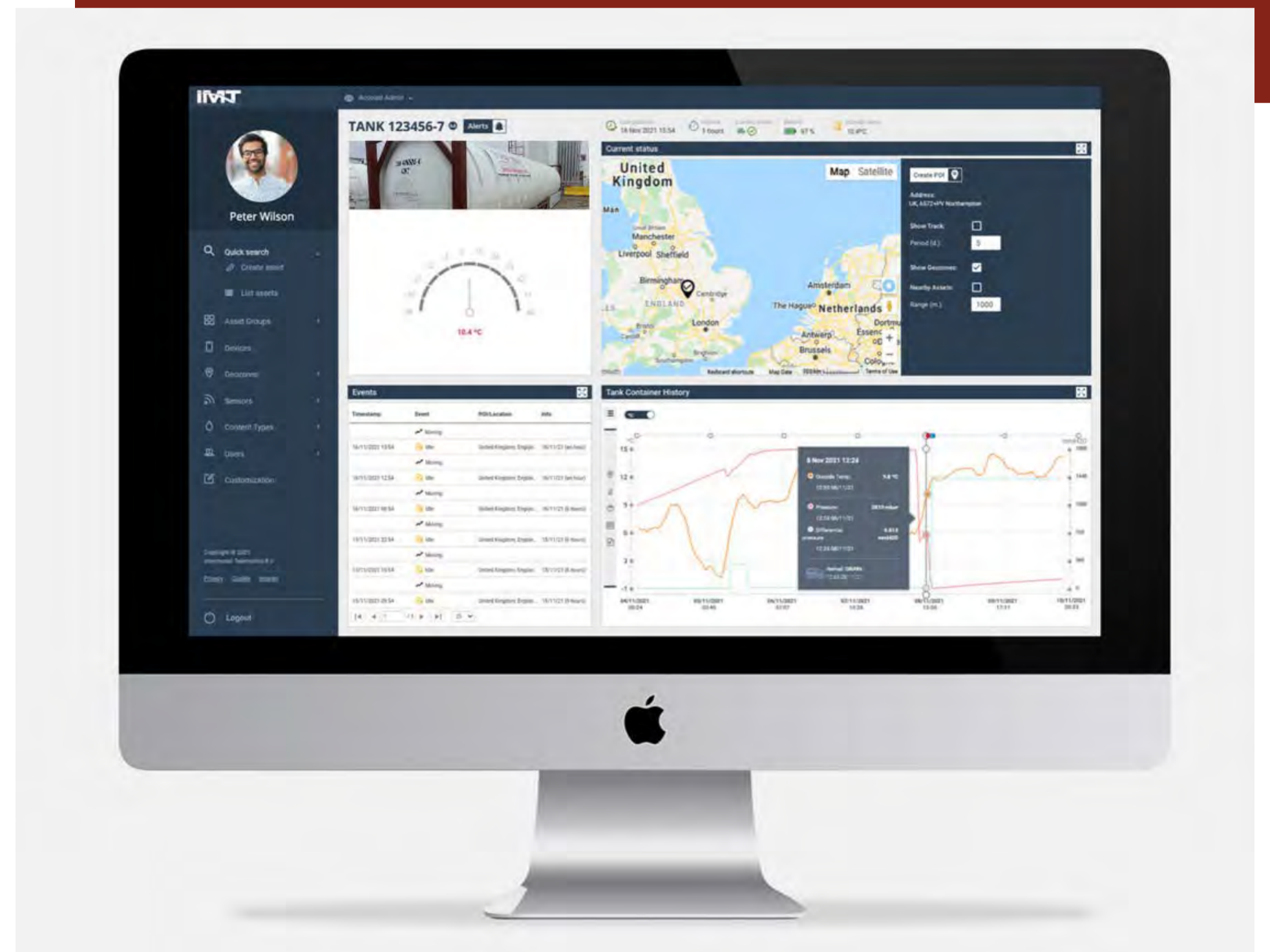
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"Our philosophy is 'Committed to Sustainable Excellence' and, in our quest for excellence, we do not compromise on sustainability. We emphasize the importance of having high standards on safety, environmental and social matters and see the digitization of our dedicated tank container fleet with IMT's telematics as a major contribution to that policy."

Thresholds can be set for both temperature and pressure via an API or manually in the IMT Web Application.



Telemetry protects people, assets and cargo

Trifleet uses an array of IMT's telemetry devices, including its WT19-Ex temperature sensor and PS20-Ex pressure sensor. IMT's award winning, solar powered CLT20-Ex (Communication & Location Terminal) collects and transmits the data from the sensors to IMT's platform.

Thresholds can be set for both temperature and pressure. These can be set automatically via an API (Application Planning Interface) between IMT's portal and Trifleet's Transport Management System, or manually in the IMT Web Application.

"Once our units are leased and leave the depot, they will effectively be under the full responsibility of our customers, so having the tools to detect any deviation from what is considered as normal levels of temperature, pressure, shock impact, and location during the lease period gives the customer the opportunity to timely respond in case of an alert from the telemetry devices," says Wullems.

To protect its assets - and its customers' valuable cargoes - the lessor also offers a geo-fencing tool to its customers, which highlights when the equipment is in, or near, locations where it is not intended to be. These could include unauthorised or unapproved depots, load/discharge points or cleaning stations.

The mishandling of tank containers can cause product damage which can then lead to serious safety issues. Impact sensors give customers the opportunity to intervene before an incident turns critical. In addition, any impact damage resulting from an incident can be investigated by tracking

back to the exact time and location of the shock, with the information contributing to burden-of-proof discussions with lessees, their customers and insurance companies.

Wullems: "Recording the often considerable load forces on a tank container's construction gives us important information about the equipment's structural strengths and weaknesses, allowing us to compare manufacturers while identifying potentially improved construction designs and the most suitable manufacturer."

"Recording the often considerable load forces on a tank container's construction gives us important information about the equipment's structural strengths and weaknesses..."



IMT preferred partner

The widescale use of sensors and telematics is a relatively recent innovation in the tank container industry, as Wullems recounts. “In 2012 I was investigating the new developments and possibilities of GPS tracking on our tank containers and briefed our board on its potential opportunities. I was convinced there would be a push for the introduction of GPS systems from both the industry and governments, and in 2017, GPS systems were made mandatory on rail wagons carrying dangerous goods.

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For example, pressure monitoring - and the possibility of measuring differential pressures - enables our customers to react before matters get out of control.

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“We started a trial in 2019 with a short-list of six suppliers and were pleased to choose Breda-based IMT as our partner to develop the functionality for our GPS proposition. This has led to a recent trial with the latest PS20-Ex pressure sensors on our cryogenic T75 tank containers, resulting in IMT being selected as the supplier-of-choice for the telematics equipment on our cryogenic fleet.

Other developments are in progress but we can already provide customers - especially those on longer term contracts - with the tools to open up the possibilities of telematics. Directly integrating sensor data into the logistic systems of customers

is already routine and is creating greater operational efficiencies in both logistics and production planning.” Wullems believes that customer and logistics supplier systems will eventually communicate directly to determine the availability of specific types of tank container.

More generally, Trifleet believes that data transmission by telemetry transforms the ability to monitor the real-time status of the fleet and generates valuable process information and management information of, for instance, idle stock.

When linked to threshold alerts, it will play a major role in accident prevention and emergency response. For non-hazardous products it can help prevent cargo deterioration, deterioration of product quality and even product loss. In these cases, the cost savings are typically far greater than the cost of the telematics device.

“For example, pressure monitoring - and the possibility of measuring differential pressures (used in some situations to determine the flow of gases and liquids) - enables our customers to react before matters get out of control.

Sudden increases in pressure can occur at several stages in the loading, storage or unloading of a tank container and may be a lead indicator of a problem. Our customers will therefore have the benefit of distinguishing between a ‘planned’ or expected rise (or fall) in pressure and an unexpected one, giving time to intervene,” says Wullems.

Trifleet uses IMT's specialist cryogenic solutions

Trifleet's cryogenic business offers T75 tank containers with cryogenic pumps and comprehensive technical support. The highly specialised equipment is used for moving LNG, air gases (argon, nitrogen and oxygen) and carbon dioxide. Tank containers therefore play an essential role in allowing LNG consumers with relatively small demand in isolated locations to gain access to cleaner-burning natural gas.

However, LNG boils at -162oC (-259oF) and static storage can be difficult due to the inherent heat input from the environment. Any warming increases the pressure in the tank container, causing the vapour pressure of the liquefied natural gas to rise until it 'boils-off' and is released from the vessel by venting through a pressure relief valve.

The amount of time the tank container can hold the LNG at these very low temperatures - without venting - is called the 'holding time' and each insulated tank is designed to offer a maximum holding time. The holding time for Trifleet's T75 cryogenic tank containers ranges, for example, from 54 days for liquid nitrogen to 150 days for LNG.

Especially on our cryogenic LNG container fleet telematics provides our customer with the correct information regarding pressure and content level.

F.i. at stationary use of the cryogenic container it enables our customers to schedule the correct timing of product delivery at the end users facility. Savings on unnecessary traffic and the saving on truck fuel, time, rest loads etc."

Telematics are available on all Trifleet's T75 cryogenic LNG units, at the request of the customer, and offered as an option for liquid and gas tank containers. For LNG, and highly corrosive products, Trifleet fits the telematics to guarantee a safe operation.

This latest adoption of pressure and differential pressure monitoring sensors expands the range of IMT telemetry applications being used by Trifleet while IMT's Pairing App makes the pairing of its sensors with a customer's GPS device quick, easy and secure. All the critical information can then be reported on a mobile phone or tablet immediately after the physical easy "plug and play" installation of the sensors and terminal on the tank container.

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Especially on our cryogenic LNG container fleet telematics provides our customer with the correct information regarding pressure and content level.

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Access to the portal and its possibilities can be an important component of the overall customer service package provided by a lessor and the package is backed by the IMT Helpdesk which receives support-related questions directly from a lessors' customers.

Sensory perception

IMT's sensors are used with transmitters for both tank containers and rail tank wagons. The transmitters monitor the physical parameters within the tank container or rail wagon and, using a standard M12 connector, send the information to the pressure sensor that wirelessly sends it to an IMT Communication and Location Terminal (CLT/HCT) located on the asset. This, in turn, sends the sensor data to the IMT platform where it can be accessed remotely by customers via IMT's web application.

Access to the portal and its possibilities can be an important component of the overall customer service package provided by a lessor and the package is backed by the IMT Helpdesk which receives support-related questions directly from a lessors' customers.

Transmitters are powered by a battery pack located within a sensor. No external energy source is required as power is only used for a very short time every minute when a measurement is made.

The data is displayed in the IMT web application and can also be accessed via IMT's open and free API (Application Programming Interface), making it easy to integrate into any pre-existing TMS (Transportation Management System). The sensor also stores the values in an internal buffer as a backup.

Sensors can be updated over-the-air at any time via the IMT Communication and Location Terminal (CLT) or Heating and Cooling Terminal (HCT), no matter where the tank container or rail tank wagon is located. Their ATEX IIC certification means that they can be used by above-ground industries where explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occasionally occur. These industries include the transportation of hazardous and non-hazardous liquids in the petrochemical, chemical, pharmaceutical sectors.

Telematics - proven added value potential and a game changer

Wullems concludes: "Basically, all operational functions can be monitored with IMT's innovative sensors as long as we have the means to measure it. It's not only limited to pressure, temperature and location - unauthorised operation, cargo theft, heating cycles, loading/discharging cycles, leakages, product quality can all be measured.

Telematics has already proven its added value potential and will be a game changer. It will have a major contribution towards safety and influence production schedules, and will be embedded into logistics planning, while its ability to monitor and remotely adjust the physical parameters of a tank container safeguards the safety and quality of its cargo. In the future, the possibilities of the Internet of Things will bring accurate, real-time data and information to the complete supply chain."

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Basically, all operational functions can be monitored with IMT's innovative sensors as long as we have the means to measure it. It's not only limited to pressure, temperature and location - unauthorised operation, cargo theft, heating cycles, loading/discharging cycles, leakages, product quality can all be measured.

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About Trifleet

Trifleet Leasing is a global Top 5 tank container leasing company. Trifleet is a prime lessor, with more than 30 years of experience. Their excellently maintained tank containers and passionate service are available everywhere in the world. For that Trifleet acts within our global network of offices, agents, depots and surveyors. Working with Trifleet means doing business with a team that passionately takes ownership and responsibility. For Trifleet this results in one promise:

AT TRIFLEET, WE'RE COMMITTED TO SUSTAINABLE EXCELLENCE.



Road Map to Telematics

The introduction of a telematics solution for your organisation cannot be summed up in one roadmap. Below is a global overview of some of the steps that could occur in a roadmap. Whatever step you take in the telematics journey, it will always lead to more insight, more efficiency and more grip on your logistics process:

01

Explore what **insights** you would like to gain into your logistics process? Do you want a good overview of where your tank containers or rail cars are located? Or do you want more safety in the transport of dangerous goods, such as chemicals? Or would you like to be able to monitor the product quality, e.g. of the wine you transport, for your customers? These questions and needs are the starting point for defining your telematics requirements.

02

Are there **processes** you want to optimise and monitor? Do you want to organise your fleet management more effectively? Telematics can make processes more efficient because the data gives you more insight into what is happening to your assets and cargo, and when. You can, for example, set up heating processes precisely and remotely, so that the product arrives at your customer at the right temperature.

03

How long do you see the telematics investment for? Sensors and devices that have a **long service life** give you more overall return. Especially if you choose telematics solutions that comply with international certifications such as ATEX and ISO, and that are also future-proof. An investment in telematics solutions is more than just a matter of money.

04

Consider with which telematics company you want to enter into a **partnership**. A number of considerations and insights may help you on your way. A partner with years of experience in telematics can advise you on the basis of the insights they have gained. A total solution provider will most likely be able to provide you with a suitable solution. A telematics company that develops its own hardware and software knows all the ins and outs of the telematics solution. In short, think about who you want to work with as a telematics partner, and enjoy telematics benefits now and in the future!

Take telematics to the next level

The driving need for intermodal solutions creates new challenges, as more different transport types are used. Telematics ensures that these different forms of transport become organized and manageable, especially when it comes to the transport of dangerous goods.



WIRELESS DATA TRANSFER

Any IMT sensor (temperature, pressure, heating...) sends the measured temperature values wirelessly to an IMT communication terminal (CLT, HCT), which in turn transmits the sensor data to the IMT web application.

SMART TANK OR RAIL WAGON

All smart sensors will serve the overall objective: improve transparency, increase safety, increase efficiency, reduce costs and make management by exceptions possible.

In depth: the tank container and telematics

At its most fundamental level, a tank container is simply a pressure vessel supported and protected within a steel frame. But complexity soon sets in – it can be constructed from stainless steel, carbon steel or composites; dimensions can vary from DNV-standard off-shore tank containers to those of standard ISO dimensions for marine tank containers and larger swap body sizes; and there is a vast array of linings and additional fixtures and fittings to ensure the safe transport of their often-hazardous cargoes.

The nature and physical characteristics of these products are well known – some are inherently hazardous while others can change to become a hazard when they are subject to temperature and pressure changes. These changes may occur at any time after the tank container has been loaded. Tank containers are acknowledged to have among the best safety record of any transport class but, among the few catastrophic events that have occurred over the decades, most have involved runaway temperatures or pressures.

Our school science lessons taught us that if the volume of a gas stays the same (as it does in a tank container), the pressure of the gas increases as its temperature increases. While tank container design and construction has focused intensively on managing the internal pressures that build up within loaded tank containers, it would seem prudent - as a minimum - to continuously monitor both of these physical properties, for which IMT has developed state-of-the-art sensors.

Take telematics to the next level

IMT offers a complete package of sensors, which we briefly explain below. Location, temperature, pressure, filling level, load status, and other values can be monitored. In the overview on this page and the next page you see the specific sensors for pressure monitoring.

Our product data sheets give the full description and technical specifications per sensor. You can request them via the Sales Team of IMT.



Communication and Location Terminal | CLT20-Ex Solar powered

A solar powered communication and location terminal which monitors the geolocation of the device and detects physical motion. Serves as a central hub for the sensors.



Pressure Sensor | PS20-Ex

The PS20-Ex is to be used together with third-party, compatible pressure transmitters to create a digital pressure sensing solution for tank containers and tank wagons.

The purpose of the PS20-Ex is to monitor the pressure inside of a tank container or rail wagon and to send the measured values wirelessly to an IMT communication and location terminal (CLT/HCT), which in turn transmits the sensor data

to the IMT platform where it can be accessed remotely via our web application. Status changes (e.g. exceeding pressure thresholds) are events and as such can serve as a trigger for alert notifications.

The PS20-Ex is **ATEX IIC certified** and can therefore be used in the transportation of hazardous and non-hazardous liquids in all sectors: (Petro) Chemical, Pharmaceutical, Food, etc.



Take telematics to the next level

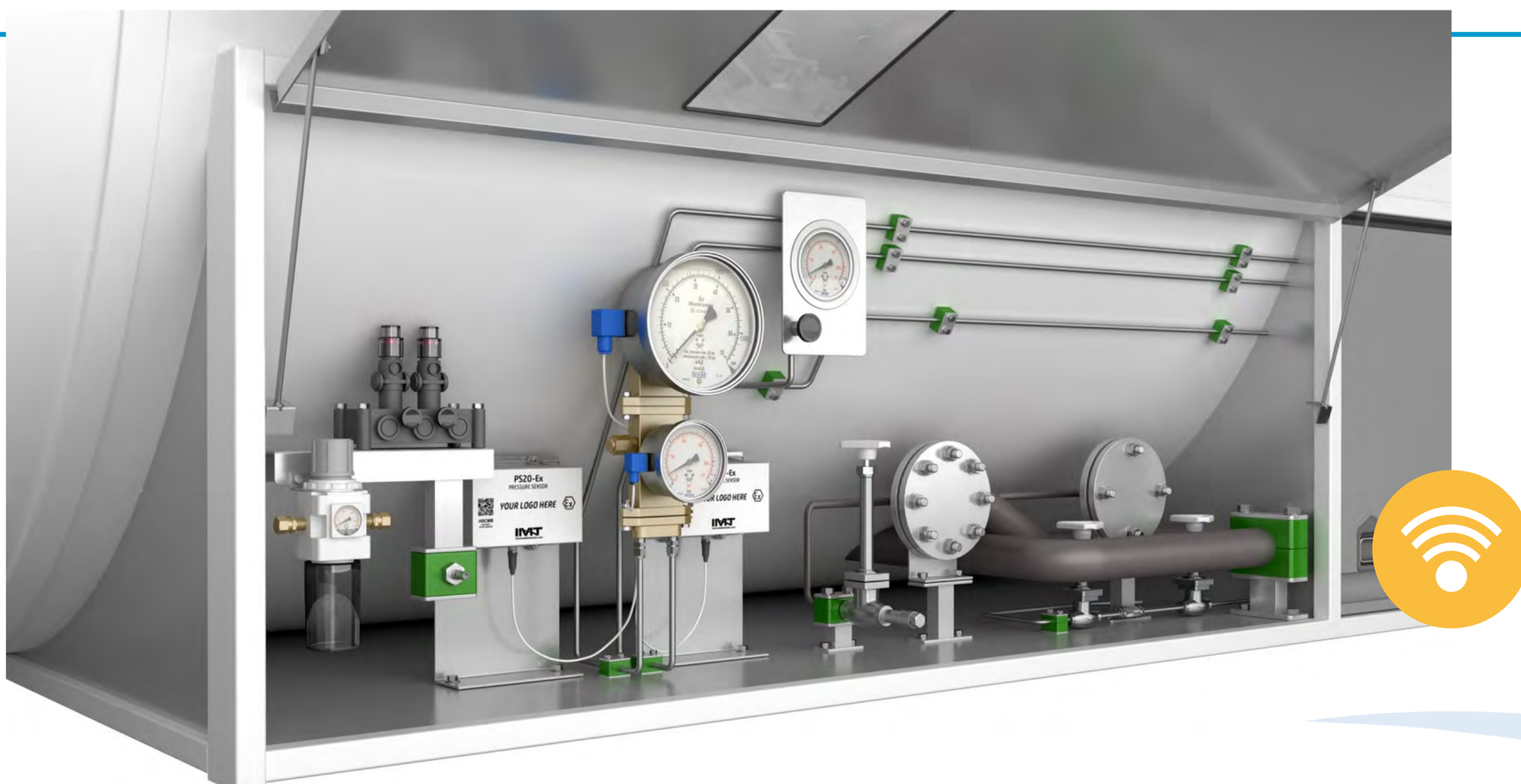
Cryogenic Solution: 3 in 1 solution Optimal insight into your pressure values, weight and location

IMT has developed a solution that gives you remote insight into the pressure values and thus the volume in your cryo tank.

IMT's cryogenic solution not only gives you insight into where your cryo tank is located, but you can also check the normal pressure and differential pressure and calculate the weight in the tank via the product specifications.

Key features of the Cryogene Solution (CS20):

- A digital pressure sensing solution for tank containers and rail wagons.
- Monitoring the pressure inside of a cryogenic tank on 2 levels:
 - 1) Pressure Gauge
 - 2) Differential Pressure.
- Possibility to automatically calculate weight. Sending the measured values wirelessly to an IMT Communication and Location Terminal, the solar-powered CLT20-Ex.
- Data can be accessed remotely via the IMT web application.
- Management by exception principle: status changes (exceeding pressure thresholds) can serve as a trigger for alert notifications.





COLOPHON

IT'S YOUR TIME TAKE THE NEXT STEP.

THESE ARE EXITING TIMES. WITH EXCITING CHALLENGES.
IMT HELPS YOU TO ADAPT THEM. SO STEP UP TO THE
CHALLENGE. GET IN CONTACT AND TAKE THE NEXT STEP.

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IMT TELEMATICS SPECIAL PRESSURE MONITORING

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