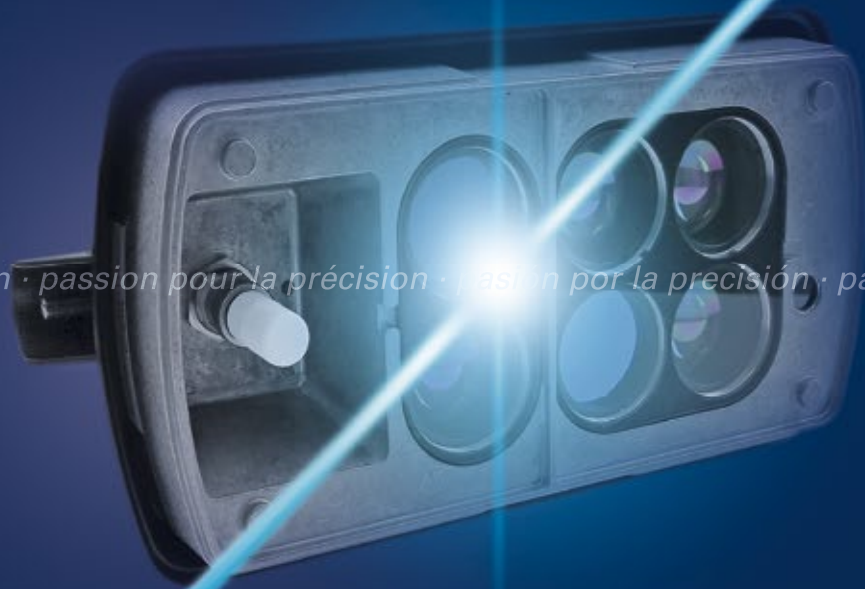


Lufft MARWIS-UMB

Mobile Advanced Road Weather Information Sensor



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 **Lufft**



Genius versus

chaos

What if we could see physics with our very own eyes? If black ice on winter roads or aquaplaning conditions were to light up before us in bright red? Quite simply, we would recognize the danger and react accordingly - whether as road users or officials responsible for safety. Chaos would hardly have a chance.

Now, we at Lufft do not possess this gift either – but we do have a different one in its place. We create little geniuses that can guide us safely and reliably through unseen dangers.

MARWIS is one such genius.

Precision on tour.

Wherever our mobile weather sensor MARWIS goes on tour, road safety immediately increases and costs fall dramatically. It relentlessly uncovers the secrets of friction, makes dangers predictable and means that mobility can be planned in any weather.

MARWIS optimizes the use of personnel and materials, provides seamless documentation, and is a good team player in exchanging data with its stationary "colleagues".



Accurately & reliably MARWIS scans the condition of any number of road surfaces at the rate of 100 measurements per second.

Mobile & in real time it transmits precise data on road surfaces: rain, ice, snow, slush, water film height, percentage ice content, relative humidity, temperature, and dew point temperature.

Lightning fast & smart from all the data it calculates the most important variable for motorists and road patrol services: friction.

Robust & flexible designed for extreme conditions, quick to install, quick to clean, quickly integrated into the "measuring team".

Efficient & consistent it helps to optimize service routes and gritting quantities to avoid weather-related traffic jams, accidents and delays, and to conserve budgets.



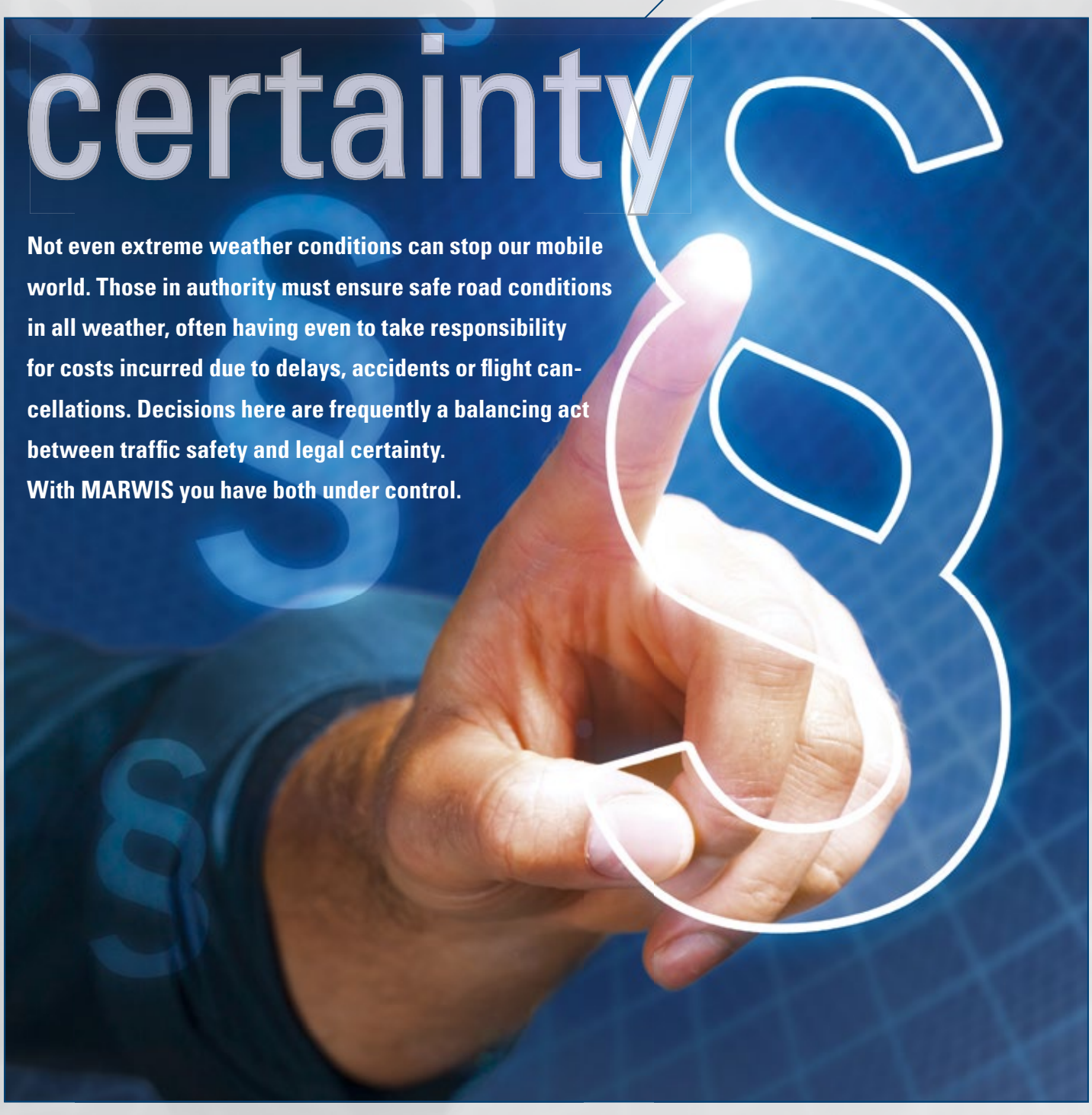
And best of all: less salt and less fine dust particles due to congestion = good for the environment!



Take sensible
decisions with

certainty

Not even extreme weather conditions can stop our mobile world. Those in authority must ensure safe road conditions in all weather, often having even to take responsibility for costs incurred due to delays, accidents or flight cancellations. Decisions here are frequently a balancing act between traffic safety and legal certainty. With MARWIS you have both under control.



Facts and figures – documented according to legal regulations.

Critical conditions, you know them well: ice, snow, and aquaplaning. MARWIS effortlessly sniffs out treacherous areas. You no longer have to guess. Based on very precise real-time values you know the score about every centimeter of runway and every centimeter of road surface, and can initiate the right measures – dead on target. And you can sleep soundly too, because in critical cases the seamlessly documented measurement data provide evidence that your decisions were in accordance with regulations.

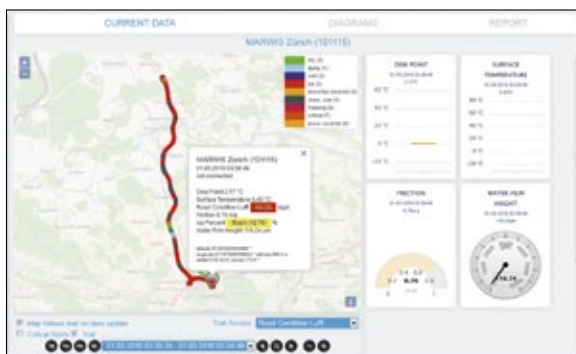


MARWIS Apps (Android/iPad) convenient mobile networking and visualization

ViewMondo the ultimate manager of all your UMB weather stations. Software for the perfect workflow between internal and external operations and multi-functional data handling.

- > Individually configurable
- > CSV format download / cloud hosting
- > Clear presentation of stationary and mobile measuring devices
- > Password-protected management, can be integrated into your central data collection system
- > Responsive design – for all browsers, tablets and smartphones
- > Individual evaluations, monthly reports, heat maps etc.
- > SnowTam - integrated digital workflow for identifying, evaluating and documenting the RCC (Runway Condition Codes)
- > Plausibility checks and integrated Federal Highway Research Institute (BAST) gritting recommendation.

In addition, with **ViewMondo** you can identify means-end relationships in the twinkling of an eye and continually improve the efficiency of your winter maintenance service.



Powerful tools help you to control, document and archive.



The fitness program
for your

budget

Have you ever missed the mark with your gritting budget? Or do you use mysterious natural phenomena to predict the weather?

Let's be honest, even MARWIS can't do that. But it can rely on concrete data, break down each weather event into measurements, and calculate correlations. After just a few service runs you already know all the critical and non-critical zones in your area. You will be amazed how much gritting material you could have saved over the years. And how much more dynamically service routes could be adapted to current needs – thanks to real-time data from MARWIS.

The license for efficiency.

The larger the area of operation, the greater the potential savings. For the complete treatment of a typical commercial airport, deicing fluids worth from €100,000 to €400,000 are applied to the runway in each operation. A saving of just 10% amounts to at least €10,000 per application run!

And now just think for a moment: how big is the area of the entire road network in all the cities on this globe?



In addition, MARWIS can directly measure ice formation on aircraft wings and also helps to check the effect of de-icing.

- > **Great efficiency** from the smallest unit – the individual gritting vehicle – to the entire fleet through central collection and analysis of measurement data
- > **Automatic adjustment** every second of the optimal spreading density through intelligent data exchange between MARWIS and the control unit in the gritting vehicle
- > **Surface measurements** e.g. possible across the width of the runway, by parallel operation of several MARWIS devices side by side
- > **Aquaplaning** – the critical point is in view at all times and risks are accurately assessed





Welcome to the future

Cars are becoming increasingly more active, interact with their immediate surroundings via sensor systems, and some even find their way alone.

Yet the vision is greater. In this vision, traffic is a balanced transport system. No traffic jams, no accidents. Weather has only little influence and traffic density is relieved through temporal-spatial distribution.

The high-density, nationwide monitoring network required for this purpose - for permanent status information of every small street - would be prohibitively expensive as a stationary version.

MARWIS clears this hurdle with ease. Because it is the network. And even more...



MARWIS won the Industrial Award 2015 and therefore counts as one of the most important innovations by a medium-sized German company.



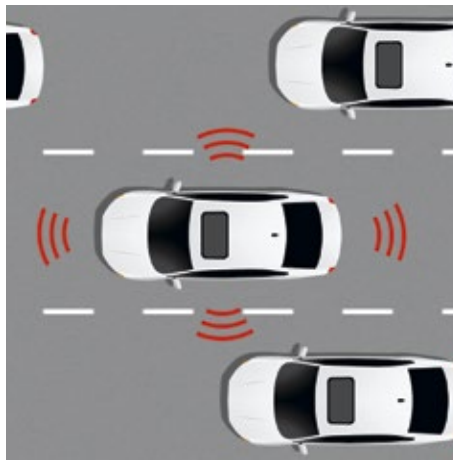
The Prism Awards are also referred to as the Oscars of Photonics. **MARWIS** was honored as a finalist by a highly professional jury.



MARWIS helped us to win an Innovation Award from the state of Baden-Wuerttemberg – also known as the Dr.-Rudolf-Eberle-Prize.

From standing start to reference status.

In the car of the future, friction measurement is extremely relevant to safety, to allow speed to be adjusted in good time in line with road holding conditions. Vehicle manufacturers today are already working in tests with MARWIS' optical spectroscopy technology. In the future, a variety of measurement sensors – mobile and stationary – will supply the cloud.



Needless to say, all of the different sources must accurately deliver the same values for the same conditions. MARWIS' precision has set standards.

- > MARWIS is currently used as a real-time friction meter in tests by many vehicle manufacturers
- > MARWIS under identical conditions delivers the same coefficient of friction as well as the raw data for friction measurement (water film in micrometers/ ice content/road surface temperature)



It is on track to be used in future as a reference method for friction measurements.



Big data –

data cloud

Paradoxical as it sounds, one of the largest growth markets gives us ever more extreme weather. We want to master it, we want to make predictions, and we want to respond quickly and appropriately. For this we need data. Volumes of weather data, seamless and comprehensive.

Technologies to manage, evaluate and provide these volumes of data have long since existed. Prospects and customers can be found in almost all sectors of industry. What is missing, or rather is not supplied in sufficient quantities, are precise measurement data. Stationary measurement networks cover only a fraction. There are huge "blank spots".

You and MARWIS can change that. Turn your vehicle fleet into a fleet of mobile weather stations.

Be first.

In the future, every meter of road will have its own IP address with all the weather information. Whoever is first to guarantee comprehensive coverage with top data quality will acquire the largest market share in this segment.



Are your vehicles on the road every day?

With MARWIS on board you could continuously and comprehensively record highly precise measurement data and deliver this to the cloud as "big data".

- > **Big data customers** – traffic systems, city authorities, navigation system providers, weather services, insurance companies, etc.
- > **Business model** – of great interest to both providers and users in terms of price due to mass use of data
- > **Autonomous driving & big data** – a model with prospects
- > **General benefits** – safe, accident-free driving and minimization of travel time



**G. LUFFT Mess- und
Regeltechnik GmbH**

Lufft Germany:

Fellbach Office:

Postal Address:

Gutenbergstrasse 20

D-70736 Fellbach

Address:

P.O. Box 4252

70719 Fellbach

Germany

Phone: +49 (0)711 51822-0

Fax: +49 (0)711 51822-41

www.lufft.com

info@lufft.de

Berlin Office:

Carl-Scheele-Strasse 16

12489 Berlin

Germany

Phone: +49 711 51822-831

Fax: +49 711 51822-944

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Lufft North America:

Lufft USA, Inc.

1110 Eugenia Pl Unit B

Carpinteria, CA 93013

Phone: +01 888 519 8443

Fax: +01 805 845 4275

E-Mail: sales@lufftusainc.com

www.lufft.com

Lufft China:

Shanghai Office:

Measurement & Control

Technology Co., Ltd.

Room 507 & 509, Building No.3,

Shanghai Yinshi Science and

Business Park,

No. 2568 Gudai Road,

Minhang District,

201199 Shanghai, CHINA

Phone: +86 21 5437 0890

Fax: +86 21 5437 0910

E-Mail: china@lufft.com

www.lufft.cn

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www.lufft.com/wondermadeingermany

