



Upper Air Sounding Systems



Meteorology – a World of Extremes

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On the ground it is + 40°C, yet at an altitude of just 11 km it is already - 60°C. From extreme dryness to extreme humidity. From complete calm to gale-force winds. Meteorology is a world of extremes and extreme conditions require maximum performance. The road to such maximum performance is long. In addition to experience and passion you need the courage to think outside the box and turn ideas into reality. Like extreme athletes, we push ourselves to the limit and beyond to achieve the extraordinary with a single focus: cutting-edge technology in the form of robust and reliable products.

Welcome to GRAW Radiosondes - the home of weather

We can't control the weather, but we can keep you informed. As one of the leading manufacturers of radiosondes, we draw upon 75 years of experience in weather measuring technology as one of the first companies to operate in this area. Our satisfied customers include weather services as well as renowned meteorological research institutes, universities and institutions worldwide.

We look forward to welcoming you as a customer and discussing your needs personally.

Florian Schmidmer

Michael Schmidmer

Radiosonde DFM-09

- Extremely light, small and robust
- Reliable and precise measurements in all atmospheric layers
- Large range thanks to the latest telemetry
- Easy handling for daily sounding

Our popular little one – in use around the world

The state-of-the-art DFM-09 is one of the lightest and smallest radiosondes on the market and is also one of the most used radiosondes in the world. It was designed for precise and reliable measurement of temperature, humidity, air pressure, wind direction and wind speed. It is easy to use, making it the ideal instrument for daily sounding.

What are your needs?

To live up to our claim of maximum measuring accuracy, we focus on the quality and performance of our sensors during development. Precise measurements across all atmospheric layers is achieved through the use of an ultra-modern and resistant ceramic temperature sensor, which is applied to a specially mirrored sensor boom in order to minimise thermal influences from solar radiation. The sensor housing and sensor boom perfectly complement each other to ensure that the housing does not affect the measurements. The humidity sensor is protected from freezing in higher atmospheric layers by a protective cap specially adapted to the wind flow and guarantees precise and error-free measurement, even under extreme conditions. Position, wind direction and wind speed are reliably determined via the integrated GPS module. The transmission range of 400 to 406 MHz

ensures sufficient scope in the frequency selection and interference-free transmission.

Better – higher – further

The powerful transmitter, state-of-the-art telemetry and the integrated GPS module ensure reliable reception up to an altitude of 40 km and over large distances up to a slope distance of 300 km (depending on the local ambient conditions). The sophisticated error correction methods (such as code spreading, interleaving, etc.) optimise reception even under adverse conditions. High-quality lithium batteries enable a long flight time of up to three hours and, in addition to providing outstanding storage properties over several years, they also fulfil all necessary transport regulations.

Radiosonde DFM-09 – Technical Data	
Weight	< 90 g, ready to start
Size	200 x 42 x 60 mm
Battery	Lithium
Battery operating time	> 140 min.
Wind finding	GPS (48 channels)
Transmission-rate	One full data set per second
Bandwidth	< 10 kHz
Frequency deviation	+/- 3 kHz
Modulation	FSK
Output power telemetry	100 mW, typical
Error correction telemetry	Code-spreading, interleaving
Windfinding options	C/A code GPS
Temperature resolution	0.1 °C
Temperature random error	< 0.2 °C
Humidity resolution	1 % rH
Humidity random error	< 4 % rH
Pressure accuracy	< 0.3 hPa
Geopotential height accuracy	< 10 m
Wind speed accuracy	< 0.2 m/s
Accuracy horizontal position	< 5 m

Unpack, initialise, fly – it couldn't be any simpler

The DFM-09 is one of the most popular radiosondes in the world thanks to its simple and user-friendly operation. The user can install and initialise the radiosonde in

no time at all. There is no need to prepare or calibrate the sensors. The radiosonde is delivered ready-to-fly, obtains all the necessary data from the groundstation during the short initialisation process and is ready to use within just a few seconds.

This makes the DFM-09 particularly suitable for mobile use, where time and flexibility are key. In addition, device variants of the DFM-09 enable pressure measurement with a pressure sensor or connection of other devices, e.g. an ozonesonde.

Tracking the ozone

We can't live with it or without it: At ground level ozone is extremely poisonous yet in the stratosphere it sustains life by protecting us from the strong UV rays of the sun. As a result ozone measurement is a key part of weather measuring technology and we have the right product for the job.

For ozone measurement, our radiosondes are connected to an ozone sensor via an interface. The GRAWMET software automatically detects the additional measurements and offers special functions.



Pilotsonde PS-15

- Small, light weight
- Compatible with all modern computers and Windows® operating systems
- Wind-detection by 48 channel GPS
- Data transmission in 400 MHz band
- Optional XDATA interface for external sensor

Our latest innovation

The pilotsonde PS-15 is based on the well-established high quality GRAW radiosonde system DFM. In fact, it is a GPS radiosonde without sensors for humidity and temperature. It can replace conventional Pilot soundings with optical radiotheodolites by a fully automatic sounding system at very low costs. The PS-15 is fully compatible with all GRAW Upper Air Sounding Systems and can be used in combination with normal PTU radiosondes. The optional XDATA interface allows using the telemetry of the PS-15 for transmitting any external sensor data down to the receiving system.

It takes only 30 seconds

Before start, the Pilotsonde is simply connected to a standard USB port of the computer. The software GRAWMET will guide you through the necessary steps (e. g. setting of the desired frequency). The complete process takes less than 30 seconds, thereafter the Pilotsonde is ready to fly. The Pilotsonde PS-15 works with one high performance Lithium battery. The running time of the battery is around 90 minutes (sufficient to reach altitudes > 25 km).

Pilotsonde PS-15 – Technical Data	
Weight	49 g (incl. battery)
Size	75 mm (height); 35 mm (diameter)
Power supply	Lithium battery
Runtime integrated battery pack	> 90 min
Frequency range	400 - 406 MHz
Frequency deviation	< 1 kHz
Transmission range	> 250 km
Pressure range	1100 - 5 hPa
Pressure accuracy	< 0.5 hPa
Wind speed range	0 - 150 m/s
Wind speed accuracy	< 0.1 m/s
Wind direction range	0 - 360°
Wind direction accuracy	< 1°
Position accuracy horizontal	< 5 m
Position accuracy vertical	< 10 m
Data output tabular	Raw data, Profile data
Data output graphical	Flight diagram, Balloon path, Hodograph
Data output messages	PILOT, BUFR

GRAWMET software

The meteorological software GRAWMET automatically detects a connected Pilotsonde and offers the reasonable functions for this application. This includes tabular and graphical outputs, generation of PILOT messages as well as BUFR codes.

Fully compatible

Thanks to the optional integrated XDATA interface, many scientific sensors (e. g. ECC ozone, CFH, etc.) can be directly connected to the Pilotsonde. The Pilotsonde is used as a carrier for the scientific data gathered by the external scientific sensors flying on the same balloon. The data will be sent down to the receiving system together with the GPS data of the Pilotsonde.



Groundstation GS-E

- Fully software-controlled groundstation
- Compatible with all modern computers and Windows® operating systems
- Flexible due to mains and battery operation for stationary and mobile use
- Optimal reception through automatic antenna switching

Simply clever

The GS-E belongs to a new generation of groundstations which are fully controlled via our meteorological evaluation software GRAWMET. Complex and expensive hardware circuits and susceptibility to error due to hardware wear are now a thing of the past. All signal processing is performed via an integrated "Software Defined Radio" application (SDR) which also optimises the reception. All receiver settings can be configured via software. This makes the GS-E a cost-effective alternative to groundstations which use digital signal processors for signal processing. This means that it is flexible to changes in signal transmission and can be adapted to new transmission standards. The receiver bandwidth of 400 to 406 MHz ensures sufficient scope and interference-free reception.

We speak Windows®

The GS-E can be used with all modern, powerful computers (desktop PCs, notebooks, etc.) and almost all Windows® operating systems (Windows® Vista, Windows® 7, Windows® 8). As every office or laboratory is equipped with a PC nowadays, this does not represent additional costs for the operation of a

Groundstation GS-E	
Weight	3300 g
Size	320 x 190 x 90 mm
Power supply	110 ... 250 V/AC 10 ... 32 V/DC
Frequency range	400 - 406 MHz
Connections	2 x 400 MHz antennas 1 x GPS antenna 1 x GPS repeater 1 x USB connection for computer 1 x USB connection for radiosonde
Tuning steps	20 kHz
Supported operating systems	Windows® Vista, Windows® 7, Windows® 8
PC	Standard PC or notebook

groundstation. Simply ask our technicians whether your computer or notebook is suitable for the groundstation.

Get some fresh air with us

The GS-E groundstation makes it possible. At approx. 3 kg, it is truly lightweight. It can be operated either with mains voltage (100 - 240 V/AC) or low voltage (10 - 30 V/DC). This makes it the ideal



solution - even for mobile use. Combine with a notebook and you're ready to go. Now nothing stands in the way of a visit to the sounding location.

Twice as nice

As standard, our groundstation is fitted with automatic antenna switching for two receiving antennas to optimally cover different sounding angles even in the case of large sloping distances. The switching is controlled by our meteorological GRAWMET software and automatically switches to the antenna with the better reception. This ensures that you always have optimum reception.

Worry-free guaranteed

We also offer tempting warranty extensions. Thanks to the fully fan-free design and the robust, encapsulated housing, the GS-E is completely maintenance-free.

Groundstation GS-U

- Fully waterproof for harsh environments
- Small and light weight with integrated battery pack
- Ideal for portable / mobile applications
- Compatible with all modern computers and Windows® operating systems
- Full-range receiver
- Fully software controlled
- Easy to operate

What do you want to achieve?

The GS-U groundstation includes our proven SDR (software defined receiver) and comes with an integrated rechargeable battery pack. It fulfils all the requirements of a modern, highly-mobile system: it is extremely small, light and ready for action in no time and offers maximum reliability during use.

Just like its sister

The GS-U is a full range system with performance characteristics similar to our well proven GS-E system. All groundstation hardware is packed in a protective and padded waterproof Pelicase with external connections to computer (USB), antenna and power supply.

The integrated rechargeable battery pack makes the GS-U an ideal solution for all mobile applications.

The GS-U is fully controlled via USB by the GRAWMET-software and behaves like a GS-E groundstation. No manual settings must be done.



Groundstation GS-U – Technical Data	
Weight	3900 g
Size	270 x 245 x 120 mm
Power supply	Power adapter 100 ... 240 V/AC / 12 V/DC Car connecting cable 12 ... 14 V
Runtime integrated battery pack	> 3 hours
Frequency range	400 – 406 MHz
Connections	1 x 400 MHz antenna 1 x USB 1 x power adapter
Tuning steps	20 kHz
Receiving range	> 100 km
Protection	IP65 (waterproof)
PC	Standard PC or Notebook (Windows®)

Groundstation GS-B

The new outdoor fashion for your expedition

The GS-B groundstation is the ideal companion for field work and expeditions. The extremely robust Pelicase housing is equipped with an integrated receiver module, an antenna switch and a GPS module for stationary GPS. In addition, a resistant and water-proof notebook (Toughbook) with pre-installed software for evaluating meteorological data is installed in the housing. All connections are also water-proof.



- The mobile groundstation for extreme ambient conditions
- With integrated, robust notebook
- Completely splash-proof design IP65

Our feature-length backup for data acquisition

In addition to operation with mains voltage (100 to 240 V/AC), the groundstation can also be operated with low

voltage (12 to 30 V/DC). This enables connection to the power supply of a utility vehicle, for example. A powerful back-up battery also provides power to the groundstation for over 90 minutes in the event of a disruption (e.g. if the supply voltage fails), so that you can always complete your sounding.

Just like its sister

Just like its little sister GS-E, the GS-B groundstation is completely software-controlled and can be operated with two 400 MHz antennas for optimal reception. In addition it offers the option of communicating with external weather stations via an RS-232 interface.

Groundstation GS-B – Technical Data

Weight	19.5 kg
Size	425 x 525 x 215 mm
Power supply	110 ... 240 V/AC 12 ... 32 V/DC
Frequency range	400 - 406 MHz
Connections	2 x 400 MHz antennas 1 x GPS antenna 1 x GPS repeater 2 x USB connection 1 x RS-232 for weather station
Protection class	IP65
Operating temperature	-10 ... +50 °C
Operating humidity	0 ... 100 % rH
Storage temperature	-20 ... +60 °C
Storage humidity	30 ... 90 % rH

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Operating temperature	-40 ... +60 °C
Operating humidity	0 ... 100 % rH
Operating wind speed	0 ... 55 m/s
Operating precipitation	Unlimited
Storage humidity	0 ... 100 % rH
Supported operating systems	Windows® Vista, Windows® 7, Windows® 8

Antennas and Antenna Systems

- For fixed installations and mobile carrier systems
- Versions for mobile use available

Always a good choice

Our antennas can be used universally, both for stationary and mobile purposes. The standard antenna system consists of an omnidirectional 400 MHz antenna, a GPS antenna for stationary GPS and, optionally, a helical 400 MHz antenna which is used for overhead sounding. They are easy to install on masts on buildings or on mobile carrier systems using appropriate brackets. We offer mobile carrier systems in a variety of versions and finishings.

Stability is key

The mobile tripod systems provide optimal support even in difficult sounding situations. An omnidirectional, helical and a GPS antenna can all be mounted on one folding tripod. In favour of lower procurement costs, reduced weight and increased flexibility the helical antenna can also be omitted.

The tripod has three continuously adjustable feet as well as a bracing mechanism and stands steadily on uneven ground or even on slopes. We can adjust the length of the connection cable to meet your needs. When it comes to transportation, we offer an optional aluminium transport box which accommodates the complete antenna system including all the connection cables and accessories.

Omnidirectional Antenna	
Type	Dipole antenna
Weight	1900 g
Height	63 cm
Bandwidth	400 - 406 MHz
Gain	3.5 dBi

Helical Antenna	
Type	Helical antenna
Weight	2600 g
Height	38 cm
Bandwidth	400 - 406 MHz
Gain	3.5 dBi

GPS Antenna	
Type	Helical antenna
Weight	230 g
Height	24 cm
Centre frequency	1575.42 MHz



	Model A (large)	Model B (medium)	Model C (small)
Own weight	7500 g	3600 g	2000 g
Pack size	20 x 20 x 110 cm	19 x 19 x 51 cm	13 x 20 x 46 cm
Structural height	min. 112 cm / max. 180 cm	min. 55 cm / max. 73 cm	min. 13 cm / max. 143 cm



GRAWMET Software

- User-friendly, intuitive operation and individually adjustable user interface
- Status viewlet for status notifications and visualisation of current sounding data
- Database-driven, graphical and tabular viewing and evaluation of meteorological measuring data
- Remote monitoring

GRAWMET Software - Technical Data	
Graphics	Profile data, Altitude diagram, Flight map (Open Street Map, Bing) Tephigram, T-Log (P), Skew-T, Emagram, Stüve diagram, Balloon track, Hodograph
Messages	PILOT, TEMP, BUFR, CLIMAT
Weather indices	LFC, LCL, CCL, Showalter Index, CAPE, CINH, EL-Equilibrium Level, K-Index, Total Index, KO Index, Refractive Index, Modified Refractive Index
Reports	Customisation, several output formats (text, pdf, csv, xls)
Statistics	Max/Min/Average values, Balloon Height statistic, Flight Path statistic
External sensors	Ozone functionality fully integrated, raw data output of other external sensors (XDATA, XML)
Data transmission	FTP, SFTP, SMS, Email, Sockets



Switch on, plug in and go

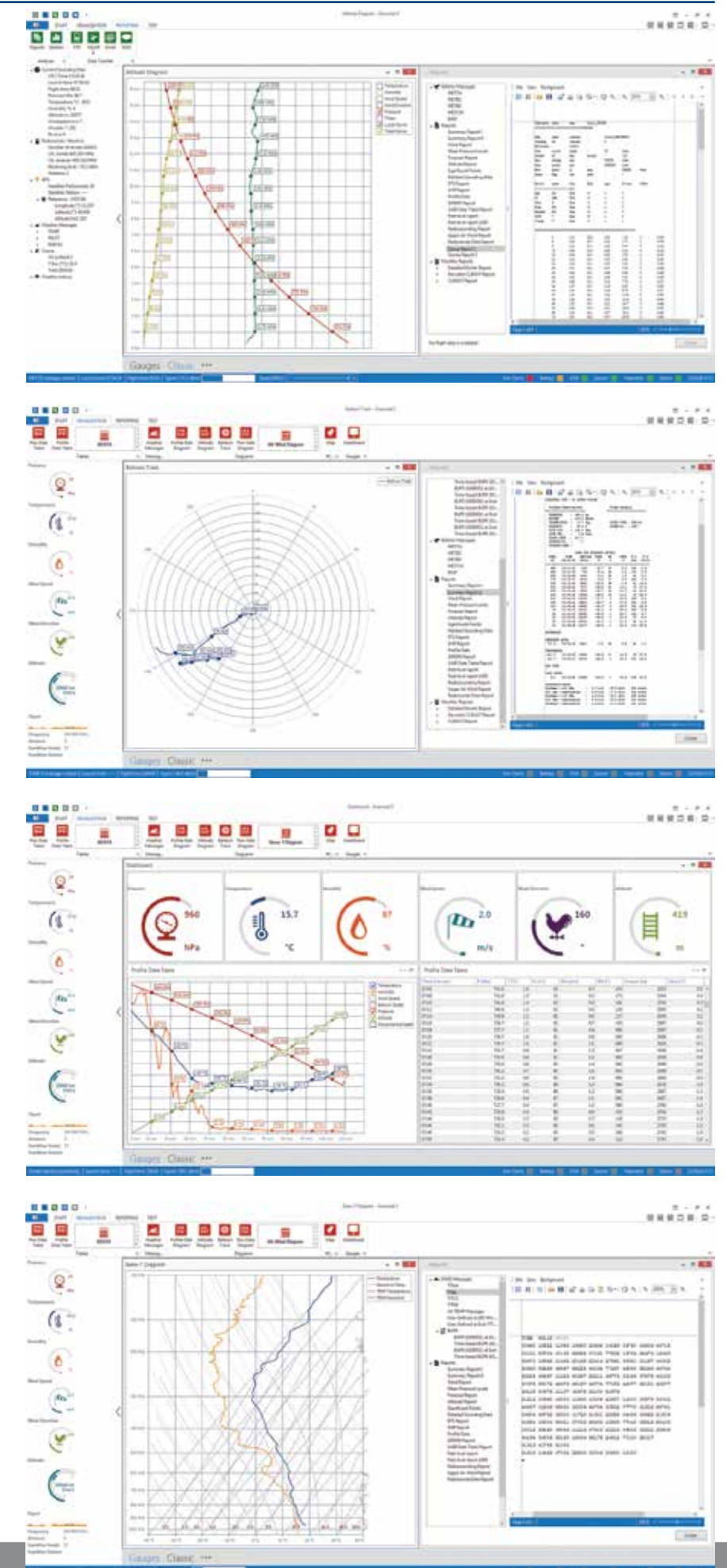
No redundant clicks. No time-consuming preparation. You can concentrate purely on the analysis and evaluation of the data. The sounding is detected automatically. You are automatically provided with the graphical and tabular views that are relevant for you. Following sounding there's no need to worry about the transfer of your results. GRAWMET takes care of this for you.

See what's happening – with the GRAWMET status-viewlet

GRAWMET allows you to always keep an eye on the status of your sounding and your current sounding data. GRAWMET offers a clear status viewlet which provides you with a rapid overview of current events, measurement data, receiver data, the status of weather messages and the quality of the data reception. A status bar or pop-up window provides real-time information regarding current events.

GRAWMET remembers everything

GRAWMET saves all results and sounding data in a database. You can call up the results of past soundings from the archive or simulate a sounding again at any time. All diagrams, reports, weather messages and weather indices are available at the touch of a button for each sounding. A statistics function also enables long-term monitoring of weather developments based on previous soundings. This enables trends to be detected and predicted.



Accessories

- Balloon filling unit for use with helium or hydrogen
- Unwinder and parachute

If you want more, you need the right equipment

We can take care of it. We provide the right equipment for any sounding and all requirements. From balloons of different sizes, unwinders and parachutes to balloon filling units.

We offer the **SO-2 balloon filling unit** in different designs for filling balloons with helium or hydrogen and for varied balloon sizes. A mechanical filling stop ensures the correct amount of gas so that you reach the required sounding speed and altitude. And for those of you on the go, we have a matching transport box for carrying your equipment.

The **SO-3 balloon filling unit** is our smallest version for use with helium. It was developed for extremely mobile use and simply consists of a filler neck, a connecting hose with pressure reducer and some filling weights.

Slow but steady wins the race

The first few metres of ascent pose the most risk for the radiosonde in the event of strong winds. Strong, sudden turbulence and the associated pulling forces place strain on the attachment and can damage the radiosonde. To avoid this, we recommend the use of unwinders. They reduce the pulling forces at the start of ascent until the balloon has reached its ascent rate. The optional parachute ensures that the radiosonde is able to safely reach solid ground again following the sounding.



SO-2 balloon filling unit



SO-3 balloon filling unit



Unwinder UW1

Technical Data	Unwinder UW1	Unwinder UW2
Weight	70 g	30 g
Cord length	30 m (other lengths on request)	30 m (other lengths on request)
Maximum payload	5000 g	600 g
Unwinding speed	approx. 0.1 m/s (payload 200 g) approx. 0.3 m/s (payload 2500 g)	approx. 0.5 m/s (payload 200 g) approx. 1.5 m/s (payload 600 g)

How it all began

■ 1938

Founding of the company Dr. GRAW Messgeräte in Berlin, Germany by the physicist Dr. Graw

■ 1942

Dr. Graw developed and patented the key component of the radiosonde, the Graw morse encoding cylinder

■ 1948

Relocation of the company to Nuremberg, Germany

■ 1976

Horst Schmidmer (owner of the NORIS Group GmbH) took over all shares of Dr. Graw

■ 1990

Development of the first purely digital radiosonde DFM-90

■ 1995

Development of the first GPS radiosonde DFM-90 DGPS

■ 1998

Development of the optimised DFM-97 GPS radiosonde

■ 2003

Company is renamed „GRAW Radiosondes GmbH & Co. KG“

■ 2004

Development starts on the GPS radiosonde DFM-06

■ 2006

Market launch of the DFM-06 radiosonde

■ 2010

Market launch of the DFM-09 radiosonde

■ 2012

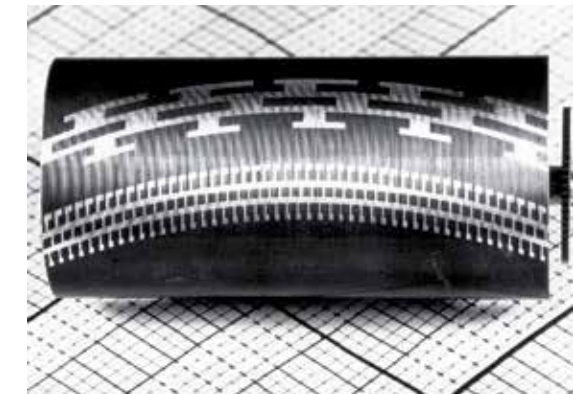
Market launch of the resilient and fully splash-proof GS-B groundstation for extreme conditions

■ 2015

Market launch of the groundstation GS-U

■ 2016

Market launch of the pilotsonde PS-15



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