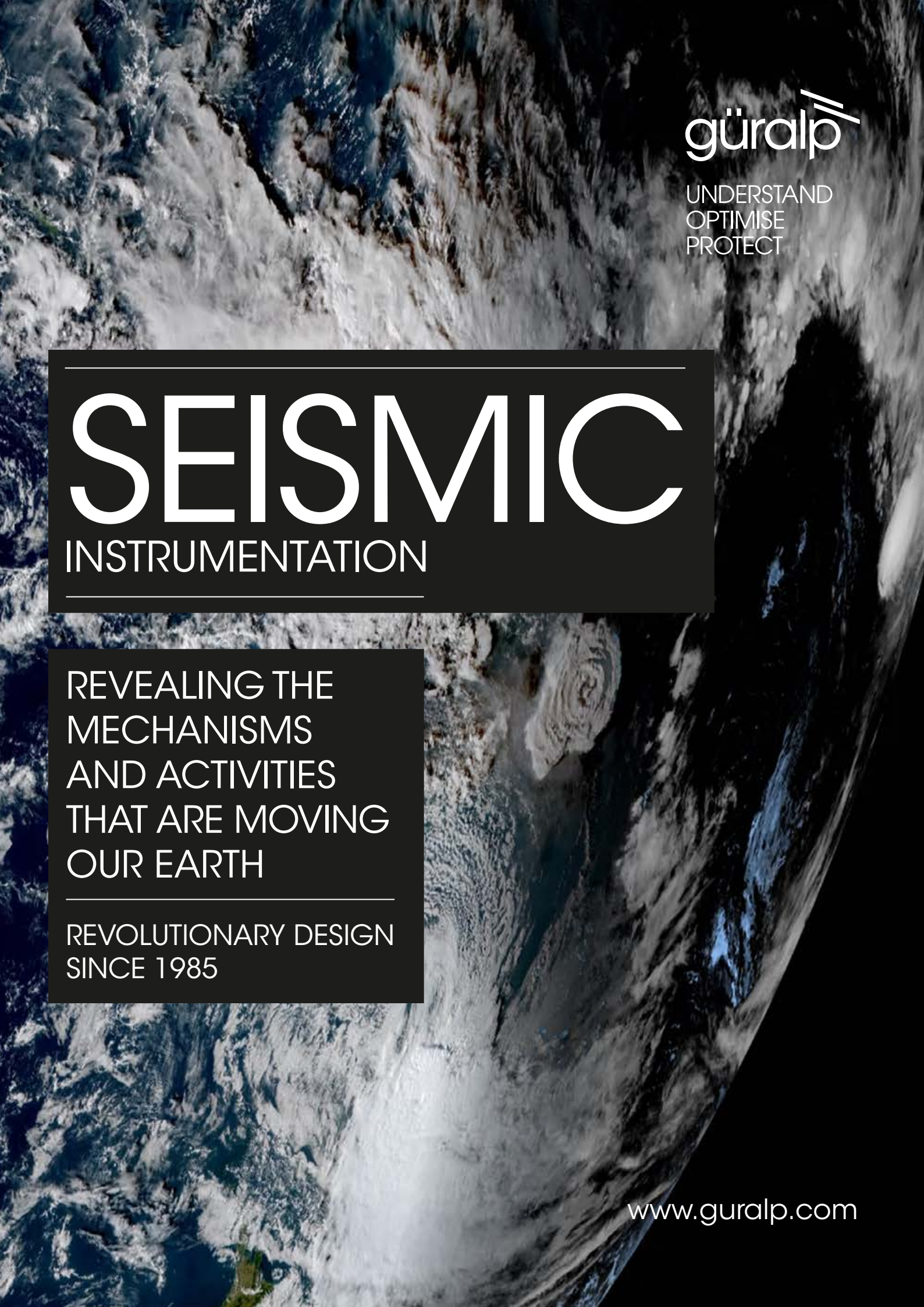


güralp

UNDERSTAND
OPTIMISE
PROTECT

SEISMIC
INSTRUMENTATION

REVEALING THE MECHANISMS AND ACTIVITIES THAT ARE MOVING OUR EARTH

REVOLUTIONARY DESIGN SINCE 1985

www.guralp.com

FRONT PAGE IMAGE CREDIT: THE COOPERATIVE INSTITUTE FOR RESEARCH IN THE ATMOSPHERE AT COLORADO STATE UNIVERSITY, THE JAPAN METEOROLOGICAL AGENCY, AND THE JAPAN AEROSPACE EXPLORATION AGENCY (CSU/CIRA & JMA/JAXA)

Güralp has been developing revolutionary force feedback broadband seismic instrumentation for more than 35 years.

Our instruments are used worldwide by academic, governmental, industrial, and commercial organisations to understand and explore our world.

All of our sensors employ the principle of negative force feedback to minimise the motion of the mass, and keep it centred within the seismometer frame. This technology vastly extends the bandwidth and dynamic range of the seismometer, recording seismic signals with periods from 360 seconds to over 100 Hz.

As a result, our sensors are capable of recording seismic events and signals of all kinds, from teleseismic earthquakes occurring on the other side of the planet, to microseismic events induced by human activity such as carbon storage injection.

Our 'next generation' of smart seismic digitisers and digital instruments offer advanced data communication capabilities and user-friendly features that make them the ideal 'plug-and-play' solution for rapid deployments and multi-scale networked arrays.

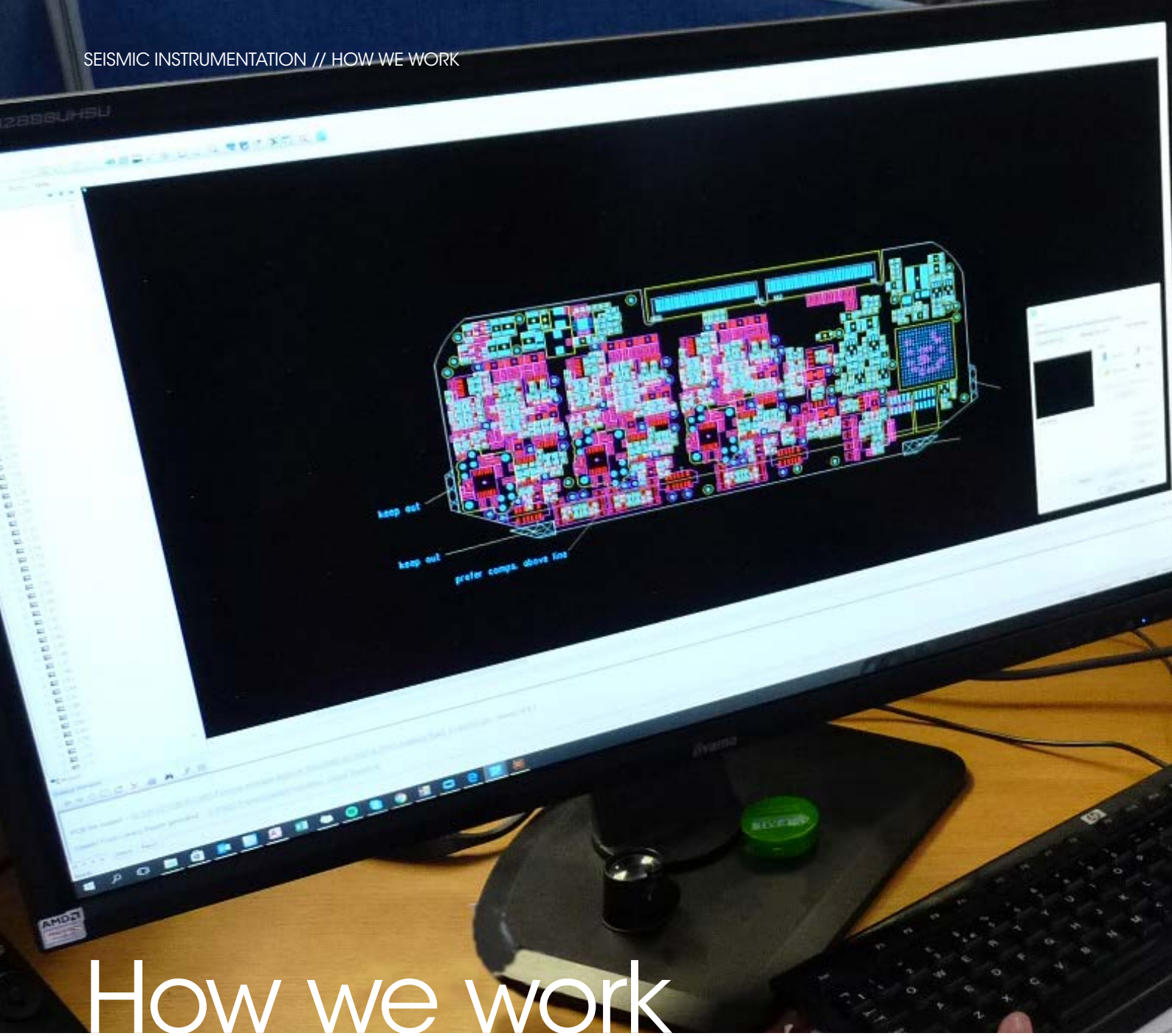
Our programme of continuous development is focused on engineering our precision technology into lower power and more convenient casings that can be installed in the harshest of environments. You will find our instrumentation employed around the globe, from the Antarctic ice sheet; to boreholes hundreds of metres deep; to the world's most active volcanoes and deepest ocean trenches.

Designed and built in the United Kingdom

All of our instruments are manufactured by our dedicated team at our specialist facilities based fifty miles from London in the United Kingdom.

Supplied to you by your local distributor

Our international network of exclusive and trusted distributors provide local expertise and knowledge to ensure that you have all you need for a successful project, wherever you are located.



How we work

Made in the United Kingdom

All of our sensors are built in clean, HEPA filtered laminar flow environments which achieve ISO Class 7 cleanliness (equivalent to FED Class 10,000).

We design and manufacture the most critical mechanical components in-house using the latest CAD/CAM technology, machining them on our four state of the art CNC milling machines. This gives us tight process control and a lean design cycle with reduced lead times so we can rapidly develop and refine product prototypes.

Our electronic assemblies meet the standards of IPC-A-610, for quality and reliability.

Robust Supply Chain Management

Those parts we don't manufacture in-house we source from a carefully selected number of trusted, specialist suppliers. Critical parts are dual sourced for sustainable scalability and resilience. The majority of our suppliers are based in the UK and are accredited to ISO9001, AS9100 or ISO13485.

All parts are subject to our meticulous QA processes before being passed to the production team.

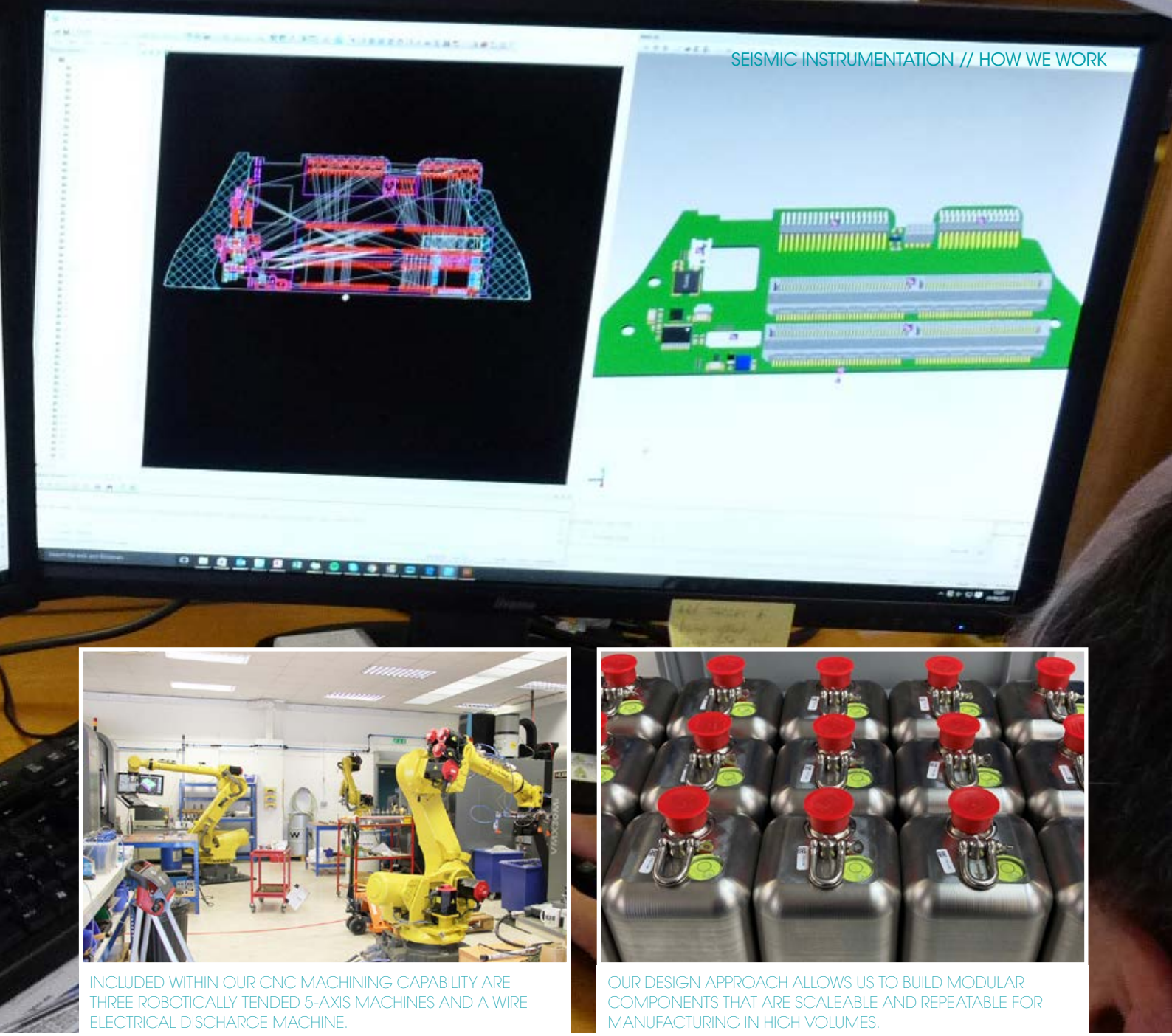
Quality Assurance

As part of our commitment to quality, all instruments are thoroughly tested at multiple stages throughout their assembly, from individual components to completed products. Before any order leaves our facility, it is subjected to a full 'user-experience' system integration test, followed by a final QA sign off.

Advanced Manufacturing Processes

We employ Continuous Improvement and Lean techniques, ensuring efficient and effective manufacturing. Our expert production team are trained across all product assemblies enabling us to respond quickly to the requirements of our dynamic market.

Our integrated manufacturing and supply chain management process is controlled end-to-end using our advanced Enterprise Resource Planning (ERP) software.



INCLUDED WITHIN OUR CNC MACHINING CAPABILITY ARE THREE ROBOTICALLY TENDED 5-AXIS MACHINES AND A WIRE ELECTRICAL DISCHARGE MACHINE.

OUR DESIGN APPROACH ALLOWS US TO BUILD MODULAR COMPONENTS THAT ARE SCALEABLE AND REPEATABLE FOR MANUFACTURING IN HIGH VOLUMES.

Our design principles

To maximise our investment in research and development we have two core design principles:

- to develop instruments constructed of modular components that are scalable and repeatable for manufacturing in high volumes to a reliably high standard;
- to eliminate, through the design process, single points of failure in our products and systems.

For larger, more complex projects, such as borehole or ocean bottom seismometer (OBS) installations, our methodology enables us to create bespoke systems from our modular components, retaining the benefits of the predictable and repeatable manufacturing of the parts, whilst meeting the unique requirements of the project.

This allows us to offer our customers the best of both worlds, a highly skilled manufacturing capability, with first class engineering expertise, utilising tried and tested components to develop bespoke solutions that meet the needs of the brief.

Supporting our customers in the field

Güralp have a highly skilled and experienced support team of engineers who focus on providing remote assistance and field services at customer sites around the world. Our engineers have in excess of fifty years' field experience, covering a range of installations in a variety of conditions; surface, downhole, ocean bottom, hot, polar, submerged etc.

Our engineers receive extensive training, including certification to work offshore in many countries. The wealth of experience of our staff ensures that Güralp is a knowledgeable and dependable provider to scalable research projects all over the world.

Our Dynamic Range

Our instruments range from observatory grade weak-motion sensors, to versatile, rapid deployment seismic stations for temporary deployments.

WEAK-MOTION	3 SERIES		3T-120 and 3T-360 are observatory grade seismometers, the 3T-360 is suited for extremely long periods. In addition to the portable casings, both sensors are available incorporated into either ocean bottom or borehole housings (see specialist casings table below).
	3ESPC		The 3ESPC is a truly portable, weak-motion, analogue instrument, suitable for deployment in areas with low to medium noise levels.
MEDIUM-MOTION	CERTIS/ CERTIMUS		Advanced Sensor Technology - our next generation, medium-motion seismometers have remotely adjustable frequency responses and operation over a ±90° tilt range. Certis is sensor only, Certimus is integarated with the Minimus digitiser. The same sensor technology is available in subsurface and ocean bottom systems (see specialist casings table below).
	ARTIUS		Artius is a three component, broadband research node designed for projects requiring high density arrays for temporary deployment in medium noise sites.
STRONG-MOTION	FORTIS/ FORTIMUS		These high-performance, compact broadband accelerometers offer flexible gain options. for every shaking scenario. Fortis is an analogue instrument and is available in a posthole casing. Fortimus is integrated with the Minimus digitiser which can provide ultra low latency data transmission for alert applications.
DUAL SENSOR	HEXIS		The Hexis combines the Fortis accelerometer and the Certis medium-motion seismometer in a single posthole instrument to deliver a total realised dynamic range that exceeds 200 dB. The gain of the Fortis and the long-period corner of the Certis are remotely configurable when partnered with a Minimus digitiser.

Specialist casings:

SUB-SURFACE	RADIAN		Advanced Sensor Technology - at just a 55 mm diameter, Radian is an ultra-slimline triaxial broadband seismometer that operates at any angle with a choice of acceleration or velocity response. Available in a posthole or borehole casing for either single or multi instrument deployments to form a vertical array.
	VERY BROADBAND BOREHOLE (VBB)		The VBB instrument family offers a choice of acceleration sensors, weak-motion velocity sensors or a combination of the two. Suitable for borehole casing diameters of between 99 - 203 mm, they can be supplied with either a surface or a downhole digitiser. Where the depth is greater than 100 m, a downhole digitiser is advised. For narrower borehole diameters, see **Radian**.
OCEAN-FLOOR	AQUARIUS OBS		Advanced Sensor Technology - the autonomous, freefalll Aquarius can be deployed to 6000 m depth. Operational over a ±90° tilt range, Aquarius is equipped with acoustic telemetry data transfer and advanced recovery and recharge systems to aid redeployment.
	MARIS OBS		Advanced Sensor Technology - the slimline Maris is a cabled system offering real time data transmission for depths of up to 6000 m. Operational over a ±90° tilt range, Maris is ideal for placement on, or coring into, the seabed.
	ORCUS OBS		A cabled ocean bottom seismometer housing either a 3T-120 or 3T-360 sensor, with a Fortis accelerometer and a 31-bit Affinity digitiser. With space for two additional environmental sensors and one sensor with serial output.
	CERTIS OBS		Advanced Sensor Technology - Certis seismic sensor offers analogue output with state-of-health parameters, fully operational at any angle. Suitable for incorporation into an ocean bottom observatory.

MODEL	STANDARD FREQUENCY RESPONSE - OTHER OPTIONS MAY BE AVAILABLE - PLEASE ASK	DIGITAL	ANALOGUE	SURFACE	VAULT	DIRECT BURIAL	POSTHOLE	BOREHOLE	OCEAN BOTTOM
3T-360	360 s - 50 Hz		√	√	√			√	√
3T-120	120 s - 50 Hz		√	√	√	√	√	√	√
3ESPC	60 s - 100 Hz		√	√	√	√			
CERTIS	120* s - 100 Hz (*config.20 - 120 s)		√	√	√	√			√
CERTIMUS	120* s - 100 Hz (*config.1 - 120 s)	√		√	√	√			
ARTIUS	30 s - 100 Hz	√		√					
FORTIS	DC - 100 Hz		√	√	√	√	√		√
FORTIMUS	DC - 315 Hz	√		√	√	√			
HEXIS	DC-100 Hz 120* s - 100 Hz (*config.1 - 120 s)		√			√	√		

POSTHOLE	120* s - 100 Hz (*config.1 - 120 s)	√					√		
BOREHOLE	120* s - 100 Hz (*config.1 - 120 s)	√						√	
3T-120 or 3T-360	120 s/360 s - 50 Hz	√						√	
5TB	DC - 100 Hz	√						√	
3T/5TB	120 s/360 s - 100 Hz	√						√	
AQUARIUS	120* s - 100 Hz (*config.1 - 120 s)	√							√
MARIS	120* s - 200 Hz (*config.1 - 120 s)	√							√
3T-120 or 3T-360	120 s/360 s - 100 Hz	√							√
CERTIS	120 s - 100 Hz	√	√						√

Our data acquisition units provide rapid, high-quality analogue to digital conversion with advanced data storage and communication capabilities. The ideal pairing whether for a single station or a fully networked array.

MINIMUS DIGITISERS

A range of 'smart' plug-and-play 24-bit digitisers with advanced data communication capabilities. an ultra-low latency mode for alert applications and sophisticated networking features. Minimus digitisers are ideal for rapid deployments and multi-scale networked arrays. Available as stand-alone units or integrated with our sensors.

Minimus units also include access to Discovery software. A single unified interface to a range of powerful tools that include network management, data quality assurance, event notifications, network performance tools and more.

AFFINITY DIGITISER

A high-fidelity 31-bit Linux-powered digitiser with integrated data acquisition and network communications unit. A convenient and expandable way of connecting digital and analogue instruments to your network, the Affinity can also provide data authentication if required.

APPLICATIONS

Map courtesy of the Global Seismic Hazard Assessment program (GSHAP), a demonstration project of natural disaster reduction, conducted by the international lithosphere program.
Assembled by D. Giardini, G. Grÿnthal, K. Shedlock and P. Zhang. 1999

OCEAN BOTTOM SYSTEMS

Our cabled ocean bottom instruments provide real-time data on seismically active regions such as Southern Europe and the West coast of North America, Our autonomous instruments are popular for instrument pools where their flexible design allows for a broad range of research applications.

INDUCED SEISMICITY MONITORING

Our instruments provide broad-band seismic data which is critical for the accurate magnitude estimation required for regulatory compliance monitoring of induced seismicity. This is particularly relevant to processes in energy production or carbon sequestration that involve injection into the subsurface.

LOCAL, REGIONAL AND TELESEISMIC ARRAYS

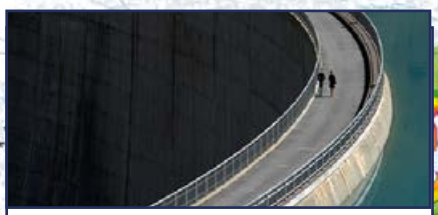
Data from our equipment deployed in local, regional and teleseismic arrays located around the globe is used to advance human understanding of how the Earth's subsurface behaves.

VOLCANO MONITORING

Our instruments are used for surface as well as subsea volcano monitoring. The equipment we provide ranges from rapid deployment temporary instruments to permanent systems for long term monitoring.

NUCLEAR TEST BAN TREATY INTERNATIONAL MONITORING SYSTEM (IMS)

We supply many of the seismometers utilised across the global IMS network and are operaters of the UK's monitoring array at Eskdalemuir, with a dedicated team on site to ensure an uninterrupted service.



DAM MONITORING

Our instruments are used to monitor the structural integrity and health of dams as well as reservoir triggered seismicity that may be present throughout the operating life of the dam. They are also used to monitor slope stability of the area surrounding the dam.

STRUCTURAL HEALTH MONITORING (SHM)

In the event of an earthquake, a SHM system allows for rapid assessment of structural integrity so you can make quick decisions on usage or occupancy. Our instruments are used to monitor civil structures, historic monuments, commercial facilities and multi-occupancy buildings.

EARTHQUAKE EARLY WARNING (EEW)

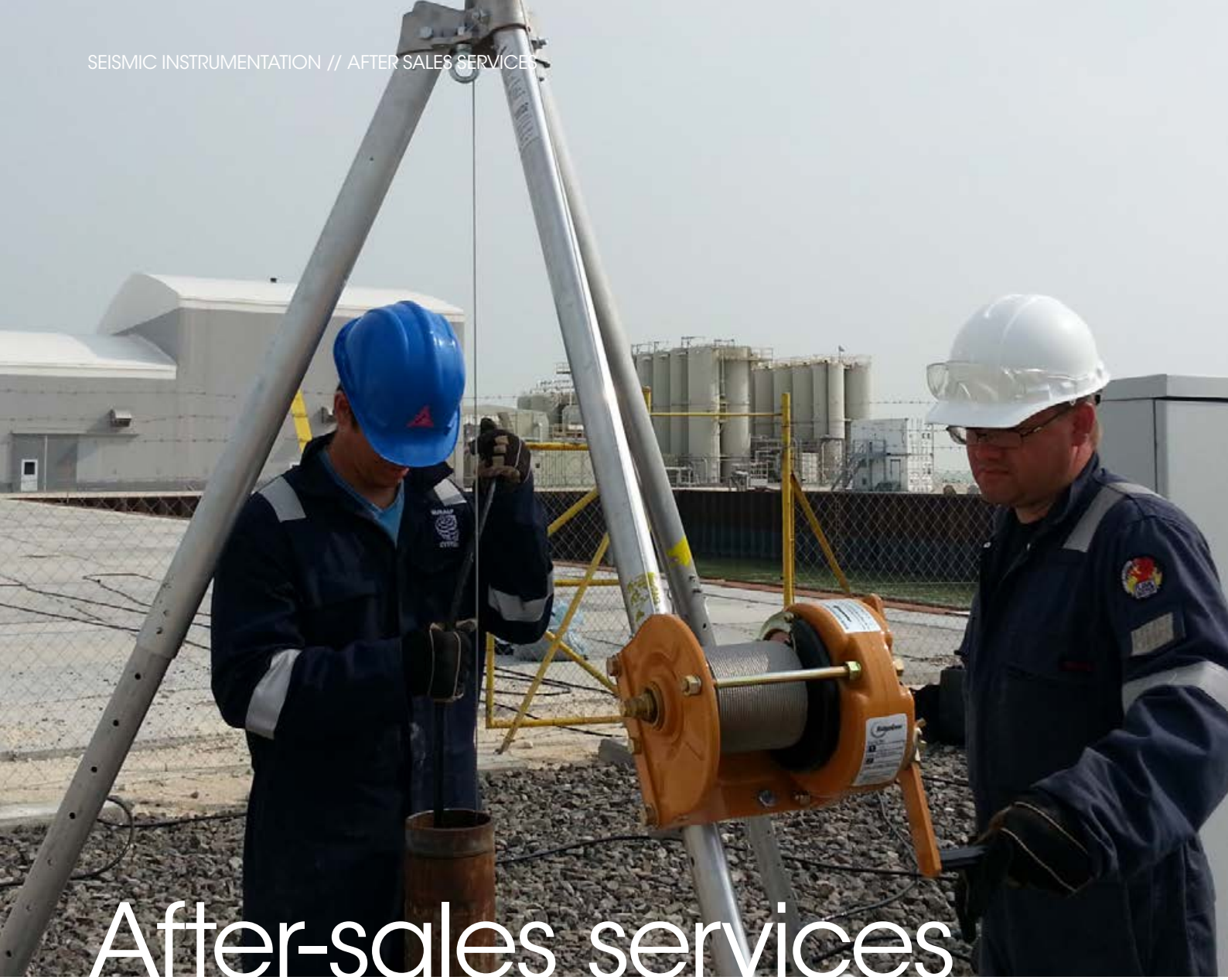
Our EEW digital instruments and digitisers are supplied with industry standard EEW triggering algorithms, Common Alert Protocol for automated emergency warning and an ultra-low-latency mode for rapid data processing and transmission.

Projection
00 At The Equator

00 1500 2000 2500 KM
00 1500 2000 2500 MI

PEAK GROUND ACCELERATION
10% PROBABILITY OF EXCEEDANCE IN 50 YEARS, 475-year return period

2.4 3.2 4.0 4.8
E HIGH VERY HIGH
HAZARD HAZARD



After-sales services

We offer a range of technical after-sales services regardless of whether you are buying new instrumentation or deploying previously purchased Güralp instrumentation. These include:

Field services

Güralp have a highly skilled and experienced team of field service engineers that undertake a variety of work at our customers' sites around the world. Our engineers have in excess of fifty years' field experience, covering a range of installations in a variety of conditions. In addition our engineers receive extensive training, including certification to work offshore in many countries.

Station and network installation

Our engineers can either work with your project team to provide specialist support or we can undertake installations in their entirety. We have deployment expertise in a range of environments for surface and vault deployments, sub-surface installations such as posthole and borehole instrumentation, and ocean bottom systems.

Training

We have developed an interactive, online training programme to enable our customers to get the maximum benefit from our Minimus-based instrumentation. The course content is split over three modules, so that users can progress to the appropriate level for their needs.

We also offer bespoke training either online, at our UK headquarters or on-site. Topics can include: product operation; site selection and operational considerations; installation methods; noise level optimisation; software configuration; maintenance; basic fault finding procedures and repairs.

Customer care

We provide on-going support for all of our instrumentation and systems, from the day they leave the factory and throughout their lifetime.

If you need product manuals, quick start guides, firmware or software, you can find links to all of these, plus answers to common questions, on our website: www.guralp.com/customer-support

Dedicated technical support

Should you have any concerns regarding your instrumentation when it arrives or, at any point afterwards, you can contact our dedicated support team for further assistance on support@guralp.com

We operate a ticketed service to monitor all enquiries and ensure that we help you resolve any issues as quickly as possible.

Where possible we will provide remote assistance to address your query. In those instances where a remote resolution isn't possible, we will advise you on what options are available to you.

Our repair team

Our highly skilled repair team have their own dedicated repair test facility allowing for fast processing and efficient repair time. We offer a comprehensive servicing and repair service to our customers regardless of whether your instrument is within warranty or not.

If the technical support team is unable to assist in resolving an operating issue remotely, then, at your request, we can arrange to assess your instrument for repair either at our UK repair facility or at one of our regional repair centres.

On receipt of your instrument we will conduct an inspection and send you a detailed report including our assessment of the instrument, the inspection findings, the repair estimation, lead times and shipping charges. We will also issue a replacement cost for comparison. You can then decide how you want to proceed.

The repairs process is actively managed to ensure all cases pass through the system as efficiently as possible. The process is fully reflected in our Warranty and Repairs policy which is regularly updated to reflect all improvements we make and which you can find on the footer of our website www.guralp.com.

güralp

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ISO9001:2015

We operate a quality management system in accordance with ISO 9001:2015 for the scope of:

'Design and manufacture of low noise broadband seismometers, accelerometers, digitisers and networking equipment for science and engineering. Software Design and development.'