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# Terason's tablet-based ultrasound system

The uSmart 3200T NexGen rises to the challenge helping Expedition 5300 record measurement of blood flow and diameter, and Carotid Intimal Media Thickness (CIMT) at high-elevations

- Lightweight compact size
- Open architecture feature
- Convenient and intuitive
- Digital Video Acquisition
- High-End image quality
- 256GB SSD HDD
- Third party app integration

### EXTREME TESTING GROUND

The Peruvian city of La Rinconada is at 5,300 meters the highest city in the world, where the population of some 65,000 people live at an altitude with oxygen levels that are on the edge of human endurance. Winter temperatures rarely rise above freezing and with no formal roads, plumbing or sewerage system, life is exceptionally hard.

So harsh are the conditions it proved the ideal location for Expedition 5300 – a group of over 15 scientists led by Samuel Vergès, from INSERM/Université Grenoble Alpes – to study the effects of low oxygen levels on health. It was also an extreme testing ground for Terason's tablet-based ultrasound system – the uSmart 3200T NexGen.

Compact and weighing in at less than 2.2 kg, the 3200T was part of several hundred kilos of specialist medical equipment which had to be transported by aircraft and all-terrain vehicles to the mountain. This was the first time such research had been carried out at this altitude. Other similar studies have, in general, been confined to heights no more than 4,000 meters above sea level.

The La Rinconada expedition was breaking new ground and would spend six weeks in the world's highest, permanent settlement, studying how its people adapt to such extreme living conditions.

The low oxygen levels are responsible for a syndrome called Chronic Mountain Sickness (CMS) resulting in the body over-producing red blood cells, causing increased blood viscosity and uneven blood flow. Symptoms include dizziness and headaches, broken sleep, breathlessness and fatigue. Cyanosis marks sufferers with a bluish cast to lips,



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“ Working in such unfamiliar surroundings the 3200T proved to be flexible and easy to use. The tablet was convenient and intuitive, with excellent imaging. Normally to get anywhere near such good resolution you would expect a much larger, more cumbersome machine. ”

gums and hands. Among the La Rinconada population, between 20 and 25 per cent present with CMS, compared to about 10 per cent or less at lower altitudes, down to 2,500 meters above sea level.

### EXCELLENT IMAGING

Dr Julien Brugniaux, a professor at Grenoble University Hospital in France, was a member of the Expedition 5300 team that travelled to La Rinconada to study the effects of living at such high altitude, where oxygen levels are half that found at sea level.

Setting up a medical laboratory in such a challenging environment, where mining for gold in the most hazardous of conditions is the main occupation of its inhabitants, was no mean task. In an attempt to acclimatise

to the La Rinconada atmosphere, the team ascended the mountain in stages. Even so some team members suffered headaches, akin to a hangover. But most fared well, with no major ill effects.

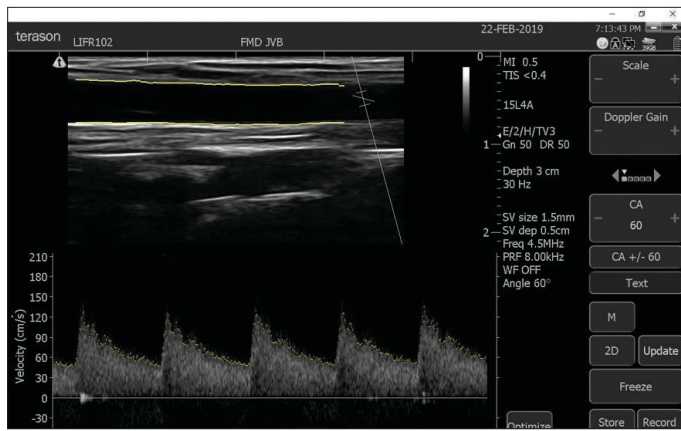
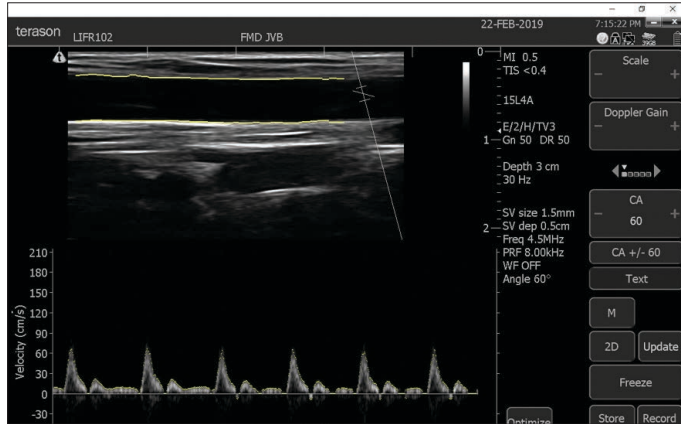
Because of its compact size and weight, the 3200T proved a welcome addition to the team's medical equipment. “The portability of the 3200T was a huge plus,” said Dr Brugniaux. “Working in such unfamiliar surroundings the 3200T proved to be flexible and easy to use. The tablet was convenient and intuitive, with excellent imaging.

“Normally to get anywhere near such good resolution you would expect a much larger, more cumbersome machine. I was very pleased with the way it performed, especially operating under such difficult





Below: Two screen images taken from the 3200T during the La Rinconada tests. These relate to flow-mediated dilation (FMD) showing baseline measurement during pre-ischemia and the second showing reactive hyperemia, on release of the cuff; Dr Julien Brugniaux with one of his volunteers at La Rinconada, studying images on the uSmart 3200T NexGen.



## Technical Specification

### 3200T NexGen

#### System Configuration

- Processor: Intel® Core™ i7
- 11.5" Wide Viewing Angle IPS display
- 8G DDR3 Onboard Memory
- 480Gb SSD (Solid State Drive)
- 802.11 a/b/g/n/ac Wireless Network
- Bluetooth V4.0

#### Imaging Features

- Enhanced Needle Visualization (ENV)
- TeraVision™ II
- OmniBeam™
- Dynamic Depth Resolution (DDR™)
- DICOM Modality Worklist; DICOM SR; DICOM Storage
- TeraZoom, TeraScape
- Auto IMT
  - Automatic measurement of the Intima Media Thickness (IMT)
  - Standard Statistics: Average, Max, Min, StD, from the near and far wall
  - High Precision, Real-Time Analysis, Fast Computation

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◀ and demanding conditions.

“The 3200T’s open architecture feature allows me to install frame-grabbing software which allows me to record the screen,” said Dr Brugniaux. “This is mightily useful as I would otherwise need to carry with me extra cables and an extra laptop to record the video.

“It also allows users to install or develop other apps, such as for calculations, that could be used in conjunction with the echograph, once again without the need for anything extra.

“In my case, recording videos directly on the 3200T’s very sizeable hard drive and thanks to the connections available, USB and SD card slot, I can easily back up my data.”

Terason’s 3200T was used to measure carotid intima-media thickness (CIMT) – a structural measurement of the thickness and stiffness of blood vessels and a good marker of cardiovascular risk.

Blood flow through the carotid artery was also measured using the 3200T. The tests were carried out with the participants at rest, but also in response to CO<sub>2</sub> challenges. For these tests, Dr Brugniaux first asked participants to breathe a gas mixture containing more CO<sub>2</sub> than normal air.

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“Since CO<sub>2</sub> is a natural vasodilator, we anticipated artery diameter to increase along with increased blood flow,” explained Dr Brugniaux. “By making participants hyperventilate we were also able to lower CO<sub>2</sub> levels in the body, expecting the opposite effect.”

While the data has not yet been fully analysed, the trend seems to be toward a smaller reactivity in the La Rinconada participants – meaning a smaller increase or decrease during CO<sub>2</sub> inhalation and hyperventilation.

#### VERY WELL RECEIVED

Other tests carried out included measuring total body blood volume, echocardiographies and polygraphy tests to assess sleep quality.

The volunteer participants were divided into two groups. Group one consisted of volunteers in relatively good health, showing no signs of hypoxia and group two displaying the tell-tale signs of CMS.

“We were very well received by the local people,” said Dr Brugniaux. “They

were very excited, some thought we had brought a cure for their ills. What health care that exists in La Rinconada is exceptionally over-worked, so our first task was to manage expectations and explain that we were there to carry out tests, not to deliver an immediate cure.”

A second expedition returned to La Rinconada in February 2020 to carry out further research. While some data has already been published, further analyses continues. The valuable data obtained during this unique project should enable the team to better understand how some people adapt better than others to low oxygen levels and how those suffering from the effects of hypoxia can be helped through structured medical care. This means that not only may those living at high altitude be helped, but also people suffering from respiratory or hematological diseases.

Expedition 5300 is indebted to sponsors Université Grenoble Alpes and INSERM.



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