



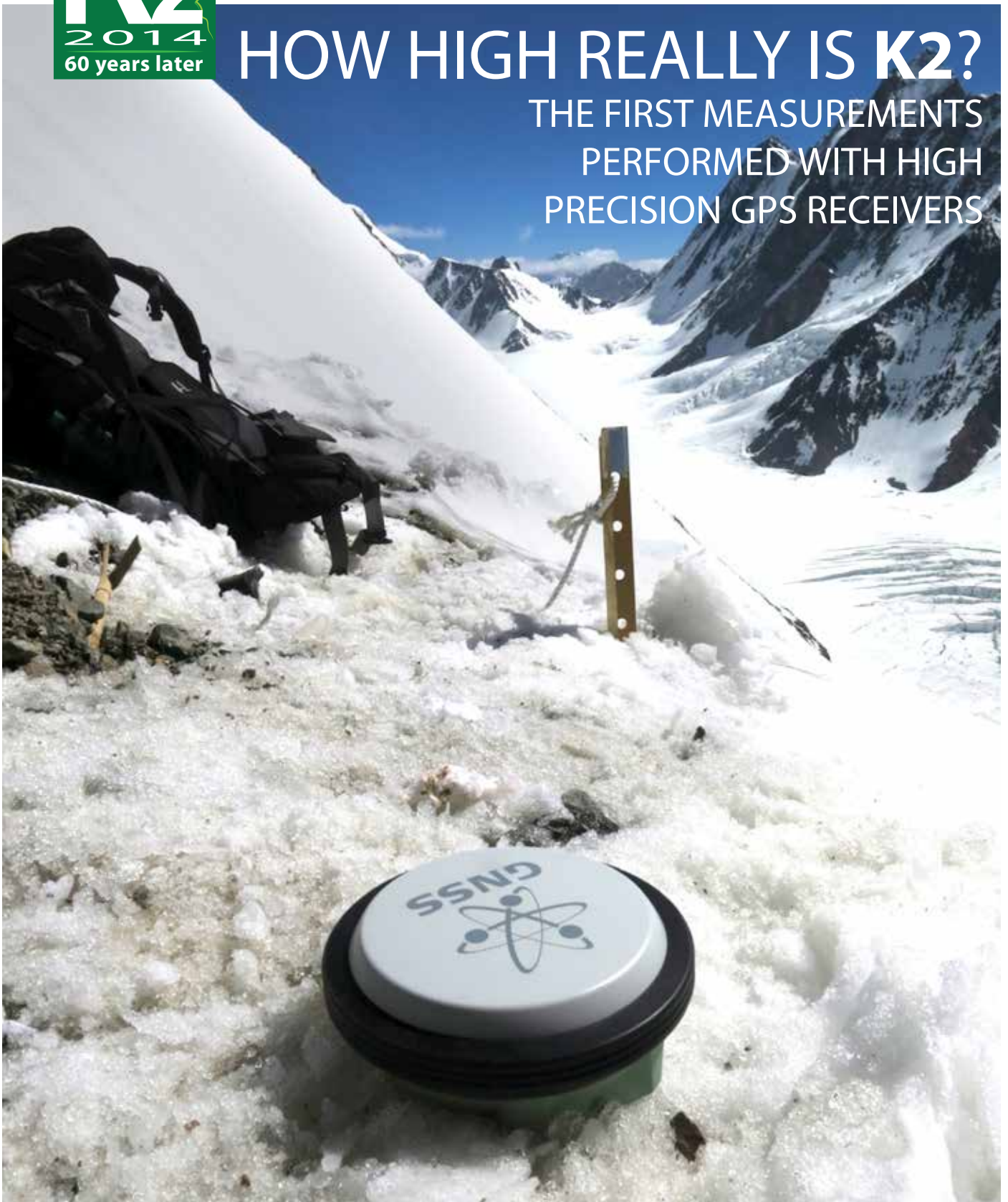
AN INITIATIVE PROMOTED
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HOW HIGH REALLY IS K2?

THE FIRST MEASUREMENTS
PERFORMED WITH HIGH
PRECISION GPS RECEIVERS



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K2 SUMMIT AND ABRUZZI SPUR CAMPS THE FIRST MEASUREMENTS PERFORMED WITH HIGH PRECISION GPS RECEIVERS

A climbing expedition promoted by the Government of Gilgit Baltistan has been carried out with the collaboration of the EV-K2-CNR Association that is operating in the Karakorum and in the Himalayas coordinating several activities, among which a network of GNSS permanent stations with the aim of detecting the tectonic movements of the mountain chain and of its glaciers.

The mission to Pakistan had the main purpose of providing the necessary technical assistance to the Pakistani climbing expedition denominated "K2 Sixty Years Later", which is a reference to the Italian expedition that first climbed K2 in 1954.

The expedition also included a scientific program which involved the measurement of the mountain with satellite GNSS technology. Researchers from KIU (Karakorum International University- Gilgit), AJKU (Azad Jammu and Kashmir University- Muzaffarabad) and Poonch University (Rawalkot) took part in this program. The computer expert of the CKNP head quarters Fida Hussain took part in the installation of the receiver in Skardu and the transmission of the data for the processing.

This had never been done in the past, because in 1996 the measurement was performed with the classical trigonometric method and in 2004 it hadn't been possible to carry the GPS receiver to the summit due to the fall of one of the climbers.

The GPS receiver chosen for this challenging measurement has been the Leica Viva GS14, designed for the most demanding environment. This GNSS receiver exceeds the toughest environmental specifications, going beyond industrial standards ensuring flawless performance even in the most challenging work places.

The instrument chosen for this delicate performance was the latest offspring of the Leica-Geosystems family, the famous company which produces high accuracy topographic instruments. This instrument, the Leica VIVA GS14, was lent to the expedition by Leica for the testing of its performances as regards portability, resistance to very low temperatures and to rugged use on rough tracks.

The instrument, presented to the researchers the day before their departure from Italy, is composed by an antenna which also contains the electronics and the data memorizing system, and by a controller linked via Wi-Fi to the antenna. The controller works like a computer that provides the right parameters to be used for the measurement.

The scientific expedition was carried out between June 22nd and the beginning of August 2014 and involved two Pakistani researchers Aamir Asghar and Hameed Fahad and two Italian researchers, Marcello Alborghetti and Giorgio Poretti, as well as the participation of Maurizio Gallo,

who installed the permanent Leica 1200+ GNSS station at the Gilkey-Puchoz Memorial and the climbers who carried the Leica VIVA GS14 to the summit. The main instrument, VIVA GS14, was put in the hands (and in the rucksack) of Remat Ullah Baig, who had the task of providing measurements at each of the five camps and on the summit of the mountain, recording for approximately 20 minutes in each location. Asghar and Poretti installed a new permanent GNSS station at the headquarters of the Central Karakorum National Park with the help of the informatics team of the CKNP Agency. This station operated for the entire duration of the expedition and is still operating to the present day.

On the return of the instruments to Italy the data were downloaded from the receivers and processed providing the following results:

Ellipsoidal and Geoidal Heights along the Skardu-K2 Trek

Location	Latitude	Longitude	Ellips. H	N	Geoid.	Err.H
Skardu (CKNP)	35°16'13.878"N	75°38'11.677"E	2359.205	-26.87	2386.081	0.0003
Gilkey-Puchoz M.	35°49'49.991"N	76°30'10.713"E	4955.952	-22.56	4978.516	0.0014
Base Camp	35°50'05.287"N	76°30'33.593"E	4940.223	-22.52	4962.741	0.001
Advanced BC	35°51'34.288"N	76°32'35.327"E	5250.390	-22.28	5272.670	0.0021
Camp 1	35°51'57.846"N	76°32'10.751"E	6037.455	-22.30	6059.755	0.0017
Camp 2	35°52'12.283"N	76°31'57.212"E	6632.027	-22.31	6654.337	0.0041
Camp 3	35°52'31.418"N	76°31'49.879"E	7307.262	-22.31	7329.570	0.0019
Camp 4	35°52'41.852"N	76°31'29.739"E	7724.709	-22.32	7747.029	0.0029
K2 Summit	35°52'53.262"N	76°30'47.703"E	8586.637	-22.39	8609.022	0.0028

These are the Ellipsoidal elevations determined by the GPS and GLONASS instruments and the Geoidal Heights (i.e. **above sea level**). N represents the difference between the Ellipsoidal and the Geoidal elevations..

Acknowledgements

The scientific research of the "**K2 60 Years Later**" expedition, was carried out with the collaboration of: **Giorgio Poretti** of the University of Trieste who organized and directed the progress of the measurements; **Agostino da Polenza, Maurizio Gallo** and **Marcello Alborghetti** of the Ev-K2-CNR Association; **Aamir Asghar e Hameed Fahad** of the Azad Jammu and Kashmir University of Muzaffarabad and of the Poonch University of Rawalkot who were trained at the University of Trieste within an educational project sponsored by the **Friuli Venezia Giulia Region**; the **Karakorum International University** of Gilgit; the **Government of Gilgit Baltistan**; the **Italian Cooperation** and the **Italian Ministry of Foreign Affairs** who support the Seed Project; **Moncler** who gave a decisive support to the K2 60 Years Later expedition; and all the alpinists of the "**K2 60 Years Later**" Expedition, with particular reference to **Rehmat Ullah Baigh** who performed the measurements at the campsites along the "Sperone Aruzzi" and carried the GPS receiver to the summit.

The expedition and the research were carried out with the patronage of the **Italian Presidency of the Council of Ministers**, the **Ministry of Foreign Affairs** and the **Ministry of the Environment**

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K2 Summit - 8609,02 m a.s.l.



Camp 3 - 7330 m a.s.l.



Camp 2- 6654 m a.s.l.



Camp 4 - 7747 m a.s.l.



Camp 1- 6060 m a.s.l.



Advanced Base Camp - 5273 m a.s.l.



Gilkey Memorial - 4978,52 m a.s.l.

