



Virtual flight around K2

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DLR scientists support expedition with a highly accurate 3D model of mountain

Considered one of the most beautiful mountains in the world and, at 8000 metres high, the most difficult to climb, K2 lies on the border between Pakistan and China. For scientists at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR), it is the perfect place for testing the latest processes for converting satellite data into 3D models. For mountaineers Gerlinde Kaltenbrunner and Ralf Dujmovits, DLR's 3D model provides an ideal opportunity to plan and analyse their ascent of K2 at the end of June.

K2, in the Karakoram mountain range, is difficult terrain for both mountaineers and the researchers at the DLR Earth Observation Center (EOC). For high-altitude mountaineers, K2 is one of the most challenging mountains; for Stefan Dech, Director of the German Remote Sensing Data Center (Deutsches Fernerkundungsdatenzentrum; DFD) at DLR, the 8000-metre mountain is the most challenging relief on Earth. "The flanks of K2 are very steep, and the high contrast between ice, snow and dark rock complicates the process of using optical data from space to create a highly-accurate 3D model." In the autumn of 2010, DLR ordered data from the US WorldView-2 satellite and made a number of special requests to the operating company, Digital Globe. "The satellite had to be extensively programmed in accordance with the requirements set by DLR engineers to record the ridges and peaks of K2 from three different viewing angles. The scientists fine-tuned the exposure sensitivity in a second overflight to avoid overexposure caused by the white snowfields.

From the collected data, the DLR researchers created views of K2 with a resolution of less than one metre. This is the first time that images of this quality have been published. The DFD operates the WorldView Regional Operations Center in Oberpfaffenhofen, under contract to European Space Imaging (EUSI), which holds the rights to sell WorldView data in Europe. As part of this cooperation, DFD is able to access the data for its own scientific analysis.

Analyses for the ascent route

The result pleased both EOC scientists and mountaineers. Perspective images and a virtual flight around the mountain, only possible using satellite technology, reveal every imaginable ascent route and illustrate the enormous magnitude of this pyramid of rock and ice. "It is really impressive to see the mountain like this," says German mountaineer Ralf Dujmovits. Since mid-June 2011 he and his Austrian wife, Gerlinde Kaltenbrunner, have been in the Himalayan region preparing for their ascent of K2. The satellite view from space is fascinating for the mountaineer: "the position of the observer in space makes the images very vivid," says Dujmovits. The two mountaineers are planning to climb K2 alongside a small international team, via the previously little travelled and technically challenging north route. Dujmovits is already the only German to have stood on the summit of every 8000-metre mountain. For Gerlinde Kaltenbrunner, it will be the final 8000-metre peak missing in her mountaineering career. "We have carefully analysed the ascent route with DLR and gained important knowledge. The 3D perspectives provide us with a great deal of information that we cannot get from maps and photographs," she says. "After the virtual exploration of our planned ascent, we have a fairly clear idea of which route we will take," adds Dujmovits.

A unique view from space

K2 was first conquered on 31 July 1954 by an Italian expedition. Since then, mountaineers have reached its summit 300 times, but 80 people have also tragically lost their lives during ascents and attempted ascents. Details of the north route are of primary importance to the Austrian-

German expedition. "There are very few flat spots for the bivouac tents on the otherwise continuously steep rock and ice buttresses, and there are narrow ice channels running laterally across the rocks that offer slightly easier ascent options. All of these details would otherwise have had to be investigated on site through arduous climbing," says Dujmovits. "What is more, we can also see the profile of the Magic Line for the first time." This is a route that Reinhold Messner devised, but which was subsequently mastered by other expeditions.

The K2 elevation model was generated using the latest stereo-optical evaluation processes at the DLR Remote Sensing Technology Institute (Institut für Methodik der Fernerkundung; IMF). The perspective images and animations were then produced at DFD. "We need elevation models for almost every geoscientific investigation. For this reason, we are researching methods to create elevation models from both optical and radar data," says Richard Bamler, Director of the IMF. The DLR researchers were able to generate special perspectives of the 8000-metre mountain between Pakistan and China, to supply the mountaineers with the most precise information possible for their ascent.

The scientists are also planning on accompanying the mountaineers during the expedition itself. "We will be continuously publishing new images, showing the position of Gerlinde Kaltenbrunner, Ralf Dujmovits and their companions," says DLR's Stefan Dech.

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Animation: DLR scientists support expedition with a highly accurate 3D model of mountain



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