

Breaking Down Borders



Engineering students use geospatial technology to help third-world communities gain access to water

Trimble technology provides accurate data in remote locations

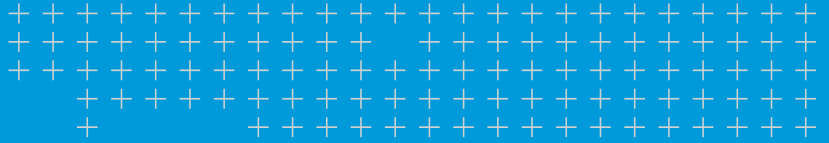
Solution

Trimble® R2 GNSS Receiver

Trimble CenterPoint® RTX

Trimble GPS Pathfinder®
Office Software

Trimble TerraSync™ Software



overview

Christian Brodbeck is standing in a small village in western Rwanda. There is no air conditioning and no breeze. There isn't running water or electricity either. And no Wi-Fi. Yet Brodbeck is producing some of the highest accuracy positioning data possible in a region as remote as any in the world. Brodbeck is using a Trimble® R2 GNSS receiver and Trimble CenterPoint® RTX satellite-delivered correction services, a combination that lets users perform precise positioning fieldwork in remote locations without relying on traditional real-time networks or a local RTK base station.



Location
RWANDA



For the last two summers, Brodbeck, an engineer in the Biosystems Engineering Department at Auburn University, has spent two weeks in Rwanda where he and six students install water distribution systems in underdeveloped communities. The projects are part of Engineers Without Borders, a nonprofit organization that delivers sustainable engineering solutions to developing countries.

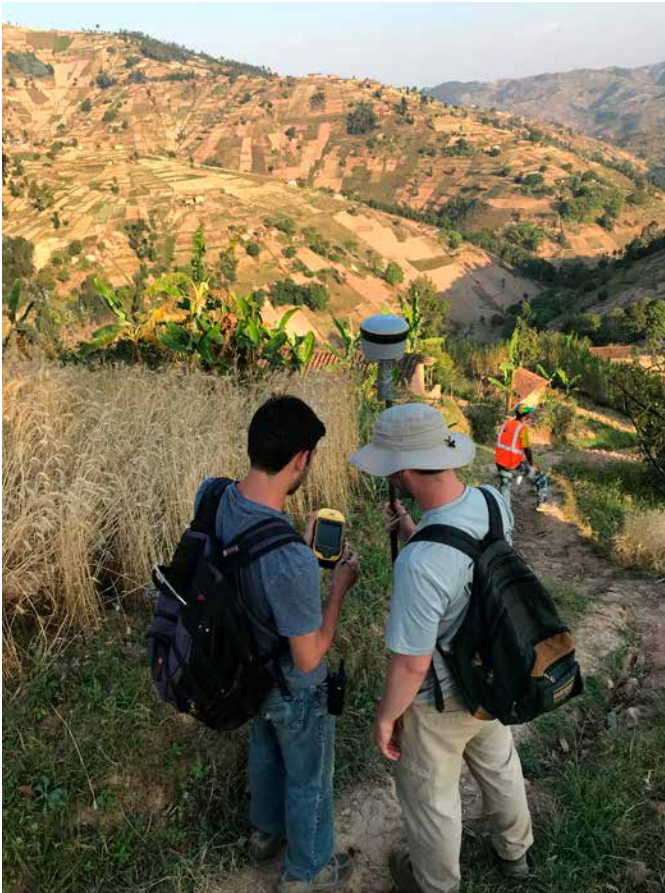
Early on, Brodbeck realized the team needed high accuracy for these projects so he contacted Trimble distributor, Navigation Electronics, Inc. (NEI), who recommended the Trimble R2 and CenterPoint RTX. "They said the Trimble R2 and CenterPoint RTX would be perfect for the work and would have the accuracy we need," he said.

Trimble R2 is a GNSS receiver that GIS and survey professionals use to collect precise data. The R2 supports real-time correction services, with

CenterPoint RTX capable of delivering accuracy of 2 centimeters horizontal and 5 centimeters vertical.

During the implementation, the team discovered Mwendo, a community of 3,000 people living at 2,400 meters above sea level. To access water, residents had to walk 30 to 45 minutes carrying 20-liter jerry cans. "The plan was to rehabilitate a 10,000-liter tank, utilize it for water storage and install a pipe directly to the Mwendo Primary School."

The location of the proposed pipeline was mapped as a line feature using Trimble TerraSync™ software. Using Trimble Pathfinder® Office software, Brodbeck exported the line data as positions only, with one point per GNSS position, allowing the line feature to be exported as points with x, y and z attributes. Exporting the data in this manner meant it could be opened with Microsoft Excel to create a table that displayed each point's actual elevation and its



distance (stationing) along the pipeline. “We used this data to model water flow to ensure water would be distributed as we had designed it,” he said. Along the pipeline they mapped areas of interest, such as locations of potential springs.

“The Trimble R2 with CenterPoint RTX allowed us to collect 4-cm accurate elevation data, which we fed into a Storm Water Management Model (SWMM) model to determine flow distribution under a variety of conditions.”

But when the team went to install the system, there were some unexpected challenges. Work on digging the pipeline trench had already started, and the trench did not follow the path the students had laid out. “This was a big deal because the trench that was dug required water to flow uphill, which as we all know, generally does not work well,” Brodbeck said.

Using the GNSS equipment the team verified that the path was incorrect and that the original location would

still work. “We used the R2 with CenterPoint RTX to verify elevations at five high points along the pipeline, ensuring elevations were lower than the source point,” Brodbeck said. “The individual points were viewed on the Map screen of Trimble Terrasync so that we could see the elevation.”

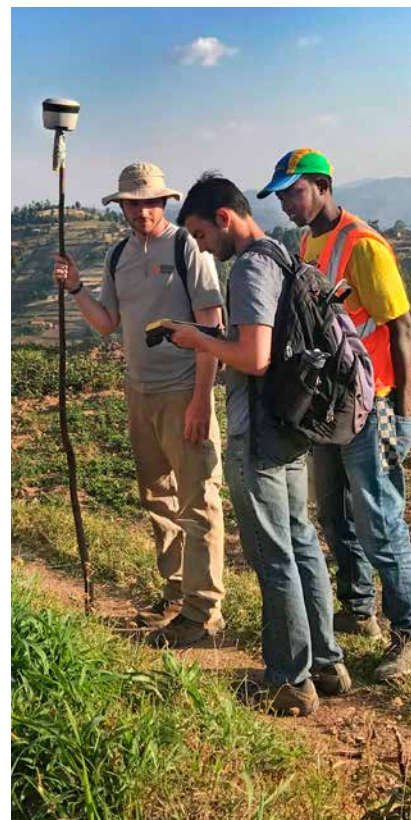
ELEVATION ISSUES

Working with the elevation change proved difficult. “For the first 300 meters of the pipeline, we only had about three meters of elevation change. After that, the terrain started to drop off so the elevation was not as critical,” Brodbeck said. “However, within those first 300 meters we had to ensure that all points were lower than the start because we were implementing a gravity-fed system. Given that the terrain was difficult, following traditional survey techniques or using an auto-level would have been incredibly challenging.”



The R2 was used extensively for assessment for future work, Brodbeck said. "We used the R2 to map potential locations for pipelines. This data would be downloaded

with Pathfinder Office and exported as SHP files to ArcGIS. Within ArcGIS, we could look at the data and start to make plans for next year."



"Trimble CenterPoint RTX provided reliable data when we needed to know the data is accurate and everything works correctly. Without this data, our design would have been incredibly difficult."

~ *Christian Brodbeck, Biosystems Engineering Department, Auburn University*



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