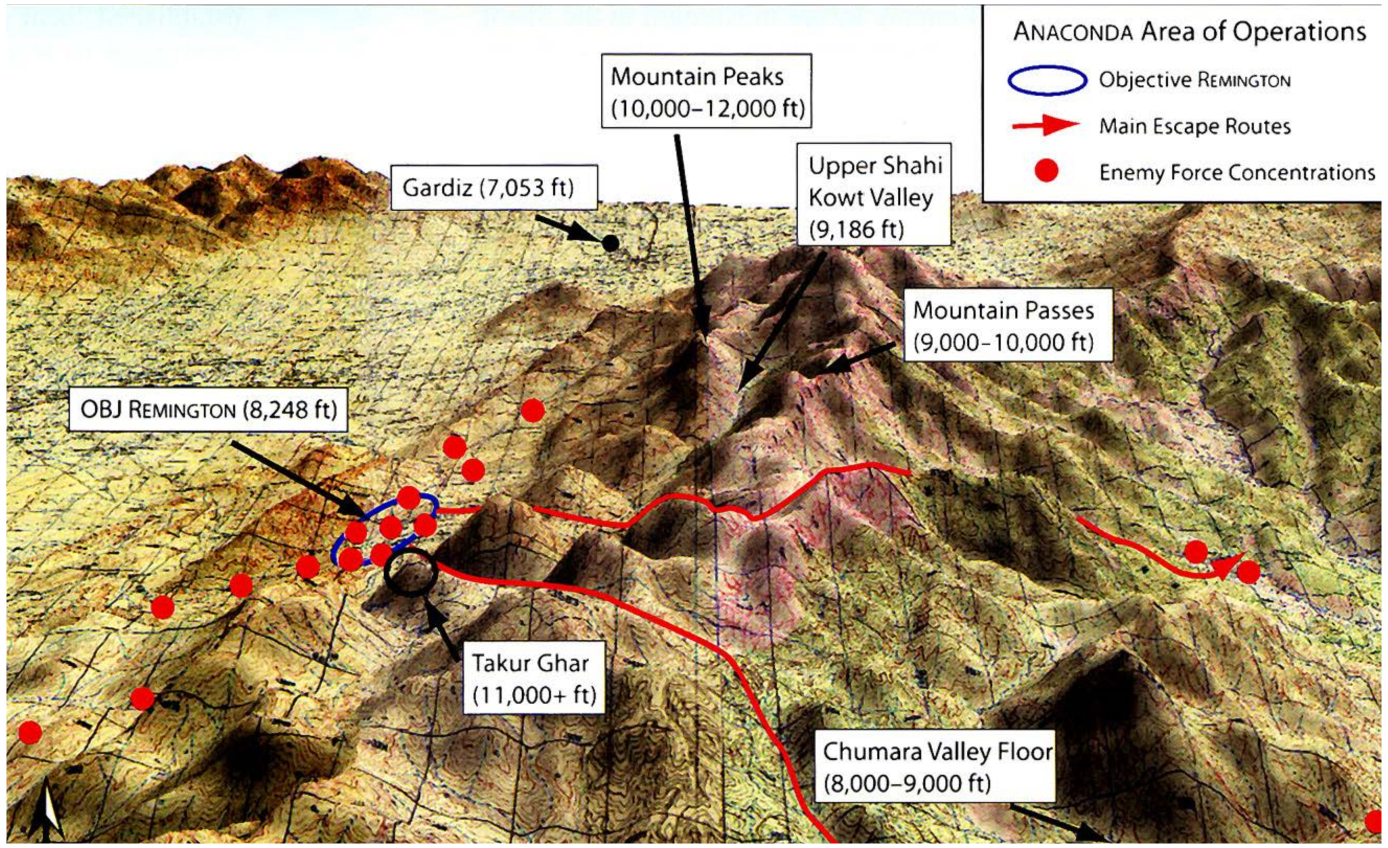
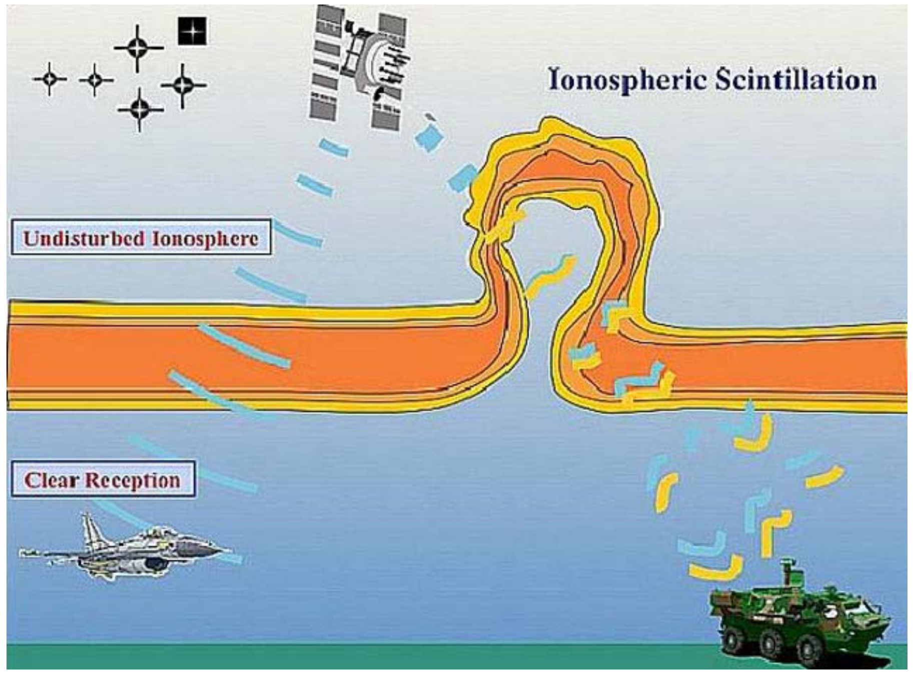
SPACE BUBBLES MAY HAVE AIDED ENEMY IN FATAL AFGHAN BATTLE

Michael A. Kelly, Joseph M. Comberiate, Ethan S. Miller and Larry J. Paxton: The Johns Hopkins University Applied Physics Laboratory, Laurel, MD, USA.

WASHINGTON, DC - In the early morning hours of March 4, 2002, military officers in Bagram, Afghanistan desperately radioed a Chinook helicopter headed for the snowcapped peak of Takur Ghar. On board were 21 men, deployed to rescue a team of Navy SEALS pinned down on the ridge dividing the Upper and Lower Shahikot valley. The message was urgent: Do not land on the peak. The mountaintop was under enemy control. →



A map of the area of Operation Anaconda showing the Shahikot Valley (outlined in blue) and the peak of Takur Ghar, which rises 3,191 meters (10,469 feet) out of the valley below. Credit: U.S. Army

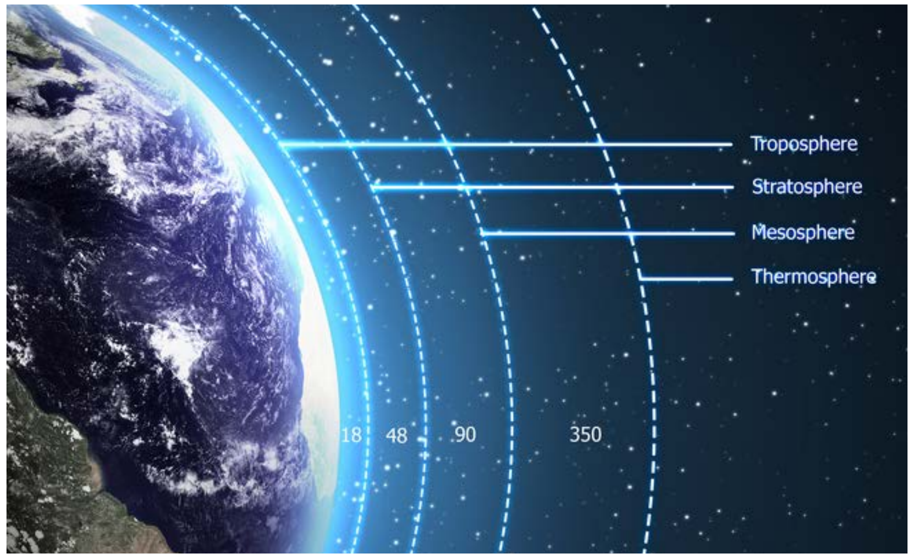


Tendrils of low-density, charged particles are called plasma bubbles, and turbulence at their edges can skew radio frequency waves passing through them. APL researchers provide evidence that plasma bubbles may have contributed to the communications outages during a 2002 Afghanistan battle. Credit: NASA

The rescue team never got the message. Just after daybreak, the Chinook crash-landed on the peak under heavy enemy fire and three men were killed in the ensuing firefight. A decade later, Michael Kelly, of the Johns Hopkins University Applied Physics Laboratory (APL), happened to read a journalistic account of Operation Anaconda, one of the first major battles of the War in Afghanistan, and thought radio operators may have been thwarted by a little-known source of radio interference: plasma bubbles.

Now, Kelly and his colleagues provide evidence that plasma bubbles may have contributed to the communications outages during the battle of Takur Ghar and present a new computer model that could help predict the impact of such bubbles on future military operations. Their work has been accepted for publication in a journal of the American Geophysical Union called Space Weather. Giant plasma bubbles – wispy clouds of electrically charged gas particles – form after dark in the upper atmosphere. Typically around 100 kilometers (62 miles) wide, the bubbles can't be seen but they can bend and disperse radio waves, interfering with communications.

OPERATIONEEL



Plasma is pervasive in the upper atmosphere during daylight hours when the sun's radiation rips electrons from atoms and molecules. Sunlight keeps the plasma stable during the day, but at night, the charged particles recombine to form electrically neutral atoms and molecules again.
This recombination happens faster at lower altitudes, making the plasma there less dense, so that it bubbles up through the denser plasma above, like air bubbles rising through water. The rising tendrils of low-density, charged particles are called plasma bubbles, and turbulence at their edges can skew radio frequency waves passing through them. In the atmosphere above Afghanistan, peak bubble season generally occurs during the spring, according to the study's authors. Given the timing and location of the battle of Takur Ghar, the researchers thought these atmospheric anomalies could have been present.

To confirm their suspicions, Kelly's team looked at data from the Global Ultraviolet Imager(GUVI) instrument aboard NASA's Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics (TIMED) mission, which launched in 2001 to study the composition and dynamics of the upper atmosphere.

Soldiers walk to the ramp of the CH-47 Chinook helicopter that will return them to Kandahar Army Air Field. A new computer model could help predict the impact of plasma bubbles on future military operations. Credit: SSG Kyle Davis – HHC 1ST BCT, 10TH MOUNTAIN

"The TIMED spacecraft flew over the battle field at about the right time," said Kelly, the lead author of the new study. That was a stroke of luck for the researchers, Kelly noted - and realizing that that spacecraft might have been there was a breakthrough moment.

Joseph Comberiate, a space physicist at APL and a co-author of the new study, developed a technique to transform the two-dimensional satellite images into three-dimensional representations of plasma bubbles. Using this technique, the authors were able to show that on March 4, 2002 there was a plasma bubble directly between the ill-fated Chinook and the communications satellite. The new model shows the electrondepleted regions of the atmosphere where radio wave interference, known as scintillation, is most likely to occur.

The plasma bubble that was present during the battle of Takur Ghar was probably not large enough to disturb radio communications by itself, but likely contributed to the radio interference caused by the complex terrain in the area, according to the new study.

Both factors ultimately led to the blackout in communications between the operations center and the helicopter, the new research says. In that kind of terrain, the radio equipment was already "operating out on the edge," said Kelly. Losing a few decibels of radio signal due to plasma bubbles "could have pushed them over the edge," he suggested.

The new model could be used to minimize the impacts of plasma bubbles in the future by detecting and predicting their movement for several hours after they form, the researchers said. The model combines data from several different satellite-based systems to detect the bubbles and uses wind and atmospheric models to predict where they will drift.

By identifying these turbulent bubbles and their paths in real time, soldiers may be able to predict when and where they will experience radio interferences and adapt by using a different radio frequency or some other means of communication, said Comberiate.
The group is currently working to validate the new model so it can be used in future military operations. "The most exciting part for me is to see something go from science to real, potential operational impact," he said.

Noot van de redactie: *Dit artikel is met toestemming overgenomen van de website van de American Geophysical Union.*