

▶ that the effects of blocking IL-7R largely agreed with the results from Zang's group. But they were unable to reproduce the results of Zang and Liu's experiments that supported a connection between IL-7R and  $T_H17$  cells as the mechanism. The discrepancy was "not likely due to differences in the experimental protocols, because we diligently followed their methods", the researchers wrote in their 2011 report in *Science Translational Medicine* (L.-F. Lee *et al. Sci. Transl. Med.* **3**, 93ra68; 2011). Stanford's Lawrence Steinman, a corresponding author on the California study, declined to comment.

But Liu says that the California experiment differed from the China experiment in an important way: the GSK team used mature  $T_H17$  cells whereas the California group used undifferentiated ones. "It's a different protocol, a different stage," he says.

Liu says that as first author he takes full responsibility for the mistakes. On 9 June, he announced his resignation on a Chinese bioscience website. Both Liu and Zang say that they stand by the paper's results and will not sign a letter to *Nature Medicine* requesting that the paper be retracted. López says that a retraction is still possible, even if not all of the authors agree to it, "if confidence in the paper is lost". In such cases, "the paper is still retracted, explaining who agrees and who doesn't agree to the retraction", he says.

Asked whether a retraction is warranted if the mistakes do not affect the paper's findings, David Daley, GSK's director of global external communications, acknowledges in an e-mail that in the period since the research was carried out, "an independent body of evidence has accumulated that the receptor [for] interleukin-7 (IL-7) is a valid target for a variety of autoimmune disorders". But he adds that "because certain data in the publication were misrepresented, we believe retracting the paper is the only appropriate action to take".

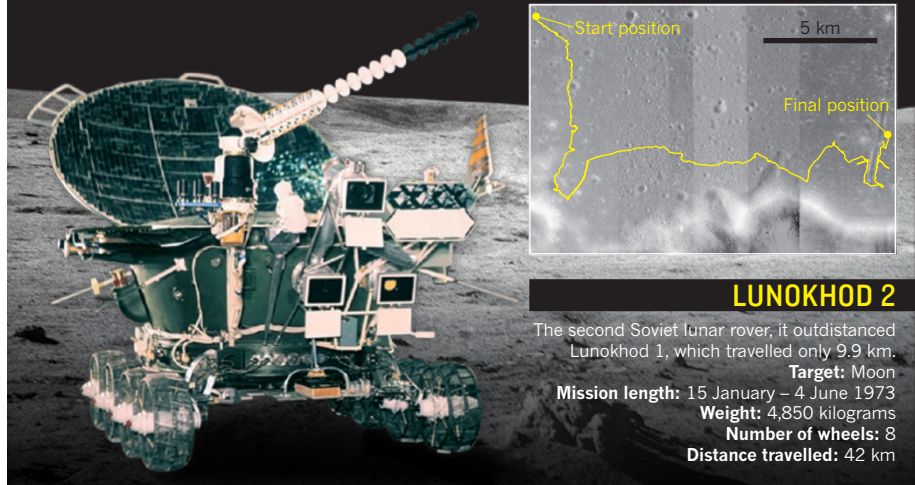
Zang, who was involved in the experimental design and in drafting the manuscript, but not in the hands-on experiments or data compilation, believes that he was fired not over data misrepresentation but for allegedly "influencing the investigation". The letter terminating his employment states that he "wilfully and purposefully undermined and misled this investigation and provided untruthful information" — charges he vehemently denies.

Daley declined to detail GSK's reasons for terminating Zang's employment, but provided a GSK statement: "We are confident in the thorough investigation we conducted and the actions we have taken as a result of our findings. We will not tolerate activity and behaviour that falls short of the high standards expected from our employees."

Zang says the whole episode is bizarre. "I still can't understand it." ■

## SPACE RACE

The Soviet moonwalker Lunokhod 2 travelled 42 kilometres, 5 km farther than scientists had long thought — delaying a chance for NASA's Mars rover Opportunity to set a new off-Earth driving record.



## EXPLORATION

# Space rovers in record race

Revised data show Soviet Union's 1970s lunar vehicle outdistanced NASA's Opportunity — for now.

BY ALEXANDRA WITZE

Alexander Basilevsky always wanted to stop driving. As a planetary geologist working with the Soviet Union's remotely controlled lunar rovers — Lunokhod 1 and Lunokhod 2 — in the early 1970s, Basilevsky was constantly asking mission chiefs to halt the rolling explorers for scientific studies, fascinated by the buffet of rocks and soil captured by the vehicles' cameras. But the bosses in the Soviet space programme were having none of it. "It is Lunokhod, not 'Lunostop!'" they told Basilevsky as they kept the rovers driving, intent on covering as much ground as possible.

Now it seems that the second rover, Lunokhod 2, went even farther than many back then had thought. New calculations, using images from orbit that trace the rover's 40-year-old tracks far below, show that Lunokhod 2 travelled some 42 kilometres in its lifetime — 5 kilometres more than the distance recorded in the official mission logs. And that means that NASA's Opportunity rover, inching up to the 37-kilometre mark after nearly a decade on Mars, has a long way to go to break the record for the distance driven by a wheeled vehicle

on another world (see 'Space race').

In a mid-May news release about Opportunity's longevity, NASA cited the 37-kilometre distance for Lunokhod 2, and some team members speculated to the press that Opportunity would soon set a new record for driving distance off-Earth. Since then, they have pulled back from any predictions of besting the Russians, even though Opportunity's odometer was at a tantalizing 36.75 kilometres as of 15 June.

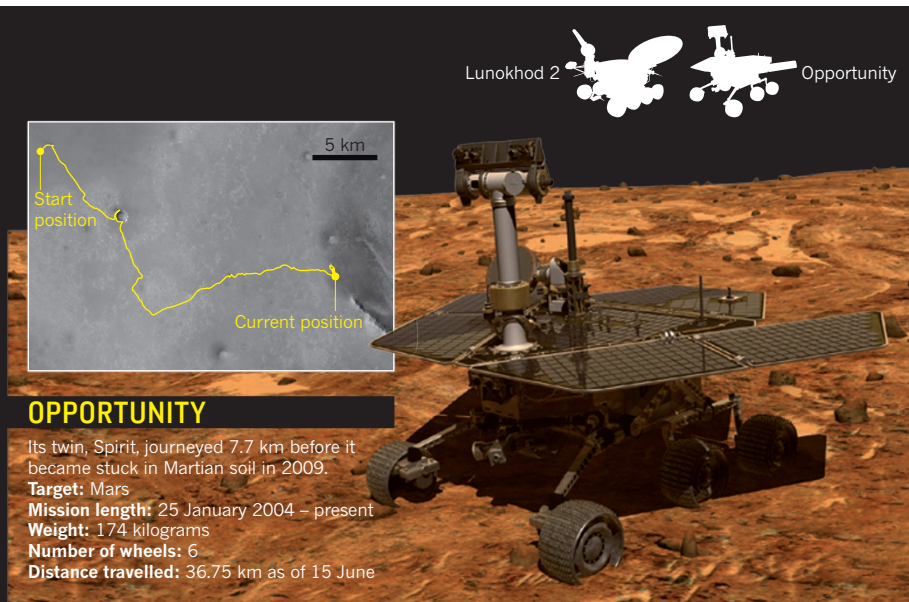
"We're not going to talk about breaking any records" just yet, says Opportunity's principal investigator, planetary scientist Steven Squyres of Cornell University in Ithaca, New York. "I'm awestruck by what the Lunokhod team managed to accomplish so many years ago, and I wouldn't want to claim that we've passed their record unless we're really sure."

Russian scientists, for their part, are quite certain about their revised 42-kilometre estimate, and have reported the findings at various planetary-science conferences over the past year.

The 1.7-metre-long Lunokhod 2 rover explored the Moon's

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For more on NASA's Mars rovers, see: [go.nature.com/fod9ud](http://go.nature.com/fod9ud)



## OPPORTUNITY

Its twin, Spirit, journeyed 7.7 km before it became stuck in Martian soil in 2009.

**Target:** Mars

**Mission length:** 25 January 2004 – present

**Weight:** 174 kilograms

**Number of wheels:** 6

**Distance travelled:** 36.75 km as of 15 June

LUNOKHOD 2: EDGAR D. MITCHELL/GRIN/NASA; RIA NOVOSTI/SPL; MIIGAIK. OPPORTUNITY: JPL-CALTECH/NASA; NASA/JPL-CALTECH/MSSS/ANMMNH

Le Monnier Crater for about 4 months, sending back 86 panoramic pictures and more than 80,000 television images. It stopped working in the spring of 1973, possibly after a close shave involving a crater wall dumped lunar soil into its interior.

The revised calculations of its journey were made by planetary mapper Irina Karachevtseva and her colleagues at the Moscow State University of Geodesy and Cartography (MIIGAiK). The team used images of the Lunokhod 2 landing site collected by the Lunar Reconnaissance Orbiter (LRO), which has been studying the Moon since 2009. They adjusted tiny line-of-sight distortions in those images using a three-dimensional representation of the Moon's topography. Tracking the rover's traverse on these adjusted images yielded the current best estimate of between 42.1 and 42.2 kilometres — very close to the distance of a marathon, the team notes.

Karachevtseva says that she is not surprised that the official mission logs are some 5 kilometres off the latest estimate. Lunokhod 2's odometer was a narrow ninth wheel that dragged behind it as it travelled, notching up distance by how much the wheel spun round. It was always thought to have had an error of 10–15%, she says — in fact, one member of the Lunokhod team who helped to drive the rover told MIIGAiK scientists that the team always thought the distances were underestimated.

The MIIGAiK team also reanalysed the path of the first rover, Lunokhod 1, which explored the Moon in 1970–71. Here, surprisingly, Karachevtseva says the team found that Lunokhod 1 had stopped short of the distance shown in the official mission logs: it covered 9.93 kilometres rather than the recorded 10.54 kilometres. A paper on the Lunokhod 1 findings is in the press at *Planetary and Space Science*, and the MIIGAiK team is finalizing

a publication on Lunokhod 2.

It is unclear why the Lunokhod 1 distance was originally overestimated and that of Lunokhod 2 underestimated, says Phil Stooke, a planetary cartographer at the University of Western Ontario in London, Canada. He speculates that Lunokhod 1 might have failed to account for wheel slip, a common problem on powdery lunar soils, whereas Lunokhod 2 might have overcompensated or had some other sort of sensor error.

Wheel slip continues to bedevil rovers on other worlds. Opportunity's twin on Mars, the Spirit rover, slipped more than expected as it climbed Husband Hill, in the Gusev Crater region of Mars. However, as it went downhill, the wheels gained traction such that the total slip was close to zero when its journey was completed (R. Li *et al. J. Geophys. Res.* **113**, E12S35; 2008).

Engineers working on Opportunity calibrate the distance it has covered by reconciling its wheel odometry daily with orbital images, says Ron Li, a Mars-rover mapper at Ohio State University in Columbus. Opportunity is currently leaving an area called Cape York, which it explored for 20 months, and heading towards Solander Point about 1.3 kilometres away, where it will try to keep working through the upcoming Martian winter. Lunokhod 2 may thus hold the extraterrestrial driving record for quite a bit longer.

For Basilevsky, now at the Russian Academy of Sciences in Moscow, the reanalysis is a fitting end to the Lunokhod story. As a scientist, he was not supposed to be in the military's mission control centre for Lunokhod 2. But he sneaked in to be present as the rover drivers navigated the alien terrain — and he likes to joke that he drove the machine remotely as well.

“This news,” he teases, “says that I was a more effective driver than I used to think.” ■