

Three months had passed since the fantastic technical feat of safely landing the Perseverance rover (Percy) in the Jezero Crater on Mars. Although the rover was working perfectly, as had all the testing apparatus, nothing particularly noteworthy had been discovered, and the initial wild ebullience of the Perseverance teams had waned.

Although it was a Sunday afternoon, Elizabeth Medcalf, Lizzy, as she liked to be called, was at her station in the JPL control room, almost alone except for her boss, Dr. Romadi, and a few other on-duty technicians. Lizzy had come to the lab after church services. She was busily re-sorting through what was to her the fascinating sounds recorded by the EDL microphone on Perseverance, the one that was initially designed to just record the sounds of the entry, descent, and landing.

Lizzy was a tiny young woman, only about five feet tall, who weighed barely over ninety pounds. And, although she was nice-looking, she always wore little, if any, makeup and dressed so demurely that no one ever seemed to notice her. Her most notable claim to fame was that she was so brilliant that she received her doctorate in electrical engineering at MIT four years earlier when she was only nineteen years old.

Although she had her Ph.D. Lizzy's position on the project was as a technician or officially as a Technologist. The standing joke at JPL was that the only persons employed at JPL without a doctorate were the janitors.

The EDL microphone was based on store-bought hardware, and no one had expected it to last this long. The microphone was located on Percy's side. It was only intended to capture the one-off pop of the parachute being deployed and then the sounds of the wind and dust rushing by during the perilous landing process.

It had surprised everyone that it had continued to work over these last three months, picking up the crunching noise of Percy's wheels turning in the regolith, the whine of the various gear motors operating the arm and the high-gain antenna, the sound of the wind and even the whirls of the occasional distant dust devils.

Lizzy's job as a technician on the EDL team was to identify and separate the individual sounds from the rover and group them sequentially. The intent was that they might detect an advance warning of potential mechanical problems with the rover from the changing of a sound.

That job was initially assigned to one of the techs handling the microphone on the SuperCam System. However, since the EDL microphone was still working, they decided to use its input as a backup.

The EDL microphone specifications were 28 to 20,000 Hz, and as expected, the engineers had set the analyzing equipment to record and search only that spectrum. Today, out of curiosity and mostly boredom, Lizzy adjusted the lower range frequency

setting down to 10 Hz, its lowest possible setting, to see if the microphone could sense anything that low. Lizzy had no idea what to expect. And, since she doubted her hearing would detect anything in that range, she coupled the output to an oscilloscope display on her console to show what was being picked up by the EDL mic.

Lizzy then switched the analyzer's input to the live feed coming from Percy. On display appeared the wildly dancing lines of a garbled combination of various frequencies and harmonics picked up by the microphone. What is known in the industry as "White Noise."

To see only what was below 28 Hz, if anything, Lizzy adjusted the analyzer's high range setting all the way down to 28 Hz, so the range of frequencies displayed would now only be 10-28 Hz.

Lizzy had expected nothing and was surprised to see a 15 Hz pulse of slightly over one-half second duration repeatedly occurring at precisely the same interval of seven seconds. She could also now faintly discern the spaced-out, steadily repeated thump in her headphones.

It clearly did not appear to be a natural sound, so Lizzy assumed it must be a pump or some other piece of equipment on Percy. She decided to check with the engineering teams tomorrow and ask them to identify it for the records.

Lizzy turned off the display, took off her headphones, and was about to get up to leave when she spotted Dr. Romadi standing behind her. She turned around in her chair and said, "I'm sorry, Dr. Romadi, I didn't see you standing there."

Dr. Kasim Romadi was a slightly built, dark-skinned scientist in his forties who had fled Iraq as a teenager and was raised by his aunt in Southern California.

"That's okay, Elizabeth. What are you doing here on a Sunday? I thought I was the only workaholic here."

Elizabeth was surprised that Dr. Romadi apparently knew her name, or maybe he just read her name on her badge?

"I was supposed to meet with a friend after church, Dr. Romadi, and she canceled out on me. Her place is not far from here, so I decided to come in and work for a while."

"I applaud your dedication."

"It's not just dedication, Dr. Romadi. I really enjoy my work here, and it's an honor to be working on this fantastic project."

"Then we are indeed lucky to have you here, Elizabeth. Can you tell me what you were so entranced with the last several minutes? I've been standing here watching for a while, and you were so deeply engrossed you didn't notice me, so I am curious as to why."

"I'm sorry, I always get that way when I am working and find something interesting."

"What was so interesting?"

"I was searching for the lower frequencies being received from the EDL microphone, and surprisingly, I found a repeating one-half-second sub-sonic pulse. It is at 15 Hz, and it repeats steadily every seven seconds. I assume it is just something mechanical on the rover, and I will check with the engineering teams tomorrow to identify it."

"Interesting indeed. Can you show me, please?"

Lizzy turned back on the oscilloscope display so Dr. Romadi could see the pulsation and handed him her headphones.

Dr. Romadi intently watched the display screen for several minutes and listened to the repeated thump. Finally, with a quizzical look on his face, he took off the headphones and said, "I don't know of anything on the rover that would make a sound like that, Elizabeth. Wait here, please."

A few minutes later, Dr. Romadi returned with an older bald technician named Herbert. He reportedly had been involved with every rover since Spirit and Sojourner. From his appearance, Herbert was probably in his late sixties or maybe early seventies. They said he had been brought back out of retirement by Dr. Romadi specifically for this project.

"Elizabeth, please show Herbert what you found. If anyone can identify the sound, it is him. He has lived and breathed all of our rovers."

Herbert listened keenly to the sound for several minutes with his face scrunched up while watching the rectangular pulses parade steadily across the display.

He then rapidly keyed commands into the terminal, switching the audio input to the SuperCam microphone on Percy's articulated arm.

Herbert switched the input back and forth between the two microphones several times while rapidly keying in commands, changing various display and input parameters for almost ten more anxious minutes.

His only comment was, "Whatever it is, the amplitude and timing are far too precise for it to be natural."

At last, he took off the headphones and stared at Dr. Romadi quietly for a moment before saying solemnly, "...Kasim, that sound is not coming from the rover. There is something out there. It's like an audio beacon."

Within two hours, dozens of scientists and technicians had re-assembled back at the control room, trying fruitlessly to ascertain the source of the bewildering sound.

By rotating the SuperCam microphone and turning Percy in a 360-degree circle, they were able to determine the sound's direction. Unfortunately, they had no idea how to ascertain the source's distance and location without having another microphone located further away to use for triangulation. Their best guess was that the source was somewhere out on the Isidis Planitia Basin, in the general direction of where the Beagle-2, the inoperative British Mars lander, came down in late 2003.

That lander had never functioned, so they were sure it could not possibly be the source. Also, since sounds do not carry far in the rarified Mars atmosphere, it had to be very much closer than Beagle-2, which was almost six hundred miles away.

Before Perseverance, only two Mars missions had included microphones as part of their design. Unfortunately, the first, the Mars Polar Lander, crashed in 1999 while landing on the surface. The second, the Phoenix Lander in 2007, had a microphone on the spacecraft's descent stage, but it was disabled before launch and, for technical reasons, never turned on. Regrettably, the Phoenix lander died after only a year due to insufficient sunlight, so there was no way to activate the microphone now.

Most of the people now crowded around Lizzy's console were sure the sound must be emitting from another nearby lander or probe, possibly from a foreign Mars mission. However, after several phone calls to international colleagues and a thorough computer search, they determined there was no known lander, probe, rover, or anything man-made anywhere near Percy in that direction.

Lizzy had slinked away from the mass of people and now stood inconspicuously against the wall, watching their animated discussions. Although they apparently did not need her any longer, Lizzy wanted to stay close by to see what transpired. Embarrassingly, she noticed that she had left the good luck charm her father had given her, the stuffed Gizmo doll, sitting prominently on top of her console.

As she quietly waited, several NASA personnel arrived along with the President's new Science Advisor, Dr. Benita Alvarez, Lizzy's idol.

After a while, the people from NASA, Drs. Ramadi, Alvarez, and a few of the scientists adjourned to the large meeting room in the back of the Control Room.

For well over an hour, from the cursory glimpses that could be seen through the blinds, they had a highly agitated meeting inside. At last, as everyone waiting outside in the control room looked on breathlessly in anticipation, the session ended, and they all came out.

After waiting a few moments to ensure he had everybody's undivided attention, Dr. Romadi announced, "We have a new prime mission for Percy, actually now the only one.

We are going to find out what is making that sound out there. ...It appears we may not be alone."

When everyone had finally quieted back down, after looking around until he spotted Elizabeth, he continued, "For the records, I am naming the unknown object "Lizzy" after its soon-to-be eminent discoverer, Dr. Elizabeth Medcalf."