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1. Aboard the *Glacier*

Obviously the Russians had the capability,
and I knew that already.

James Van Allen

Larry Cahill sardined himself into the communication shack with James Van Allen, who had headphones popped over his ears. It was quite hot and late at night. Both were thankful that they could be near the top of the ship, because that was farthest from the blistering engine room.

“Well, I wonder if that could really be it,” Van Allen said to nobody in particular. There was this inexplicably goofy beep-beeping sound in the headset. Something didn’t add up here. He glanced around. On the assembled faces were looks of confusion, like something didn’t fit. Like a game of Clue—everybody knew it couldn’t be Colonel Mustard with the rope, but all the evidence said otherwise.

What bugged him was the frequency, this 20-megahertz business. It was a common enough spot on the dial for amateurs. The National Institute of Standards and Technology’s radio station wwv used it too. And it *never just beeped*. If this new signal was indeed genuine and its creators were playing by the rules, it would be coming through at 108 megahertz, like everybody agreed upon.

Van Allen asked, “Do you think we’re getting some kind of weird transmission effect from a terrestrial station?” He wasn’t at all sure what to think, so there was a dissonance ricocheting through his brain. He had heard the news. The news was out there, but they were out *here*, in pretty much the middle of nowhere. And learning more wasn’t as easy as calling the neighbors. They had to take what came through, and right now there wasn’t much.

“Do you think this is really true, Larry?”

Three hours earlier a bearded, grimy, forty-two-year-old James Van Allen had been stuffing his face in the ship's mess. They were a few days west of the Panama Canal, which coincidentally enough was also forty-two years old. Van Allen and Cahill were passengers on the *USS Glacier*—a naval ice-breaking ship ultimately bound for the Antarctic Ocean and perhaps the last place to find two physicists from the Midwest. On paper the vessel was working *Operation Deep Freeze III*, aiming to pulverize ice for supply ships traveling between New Zealand and Antarctica. But that wasn't everything that the ship did; it also carried some thirty-odd secondhand rockets stashed down in the hold, which figured into Van Allen and Cahill's plans along the way.

Two guys with rockets? Did the captain even know? How on earth did they get aboard? For others, it might not have been so easily done. Over the preceding eleven years, James Van Allen had come to be something of an authority in the slightly obscure field of high-altitude research and had gotten to this point by playing a brilliant series of cards.

It had been a regular day, that October 4. Van Allen was familiar enough with creaky government ships to think of himself as an old hand while living on them for months at a time. He'd been in the navy in World War II through two tours—plenty long enough to demonstrate how the radio proximity fuze he coinvented could help bring down lots more enemy aircraft. That was his first card, and a professor of Van Allen's had guided him into the position of being able to lay it down.

Antiaircraft artillery is most effective when it's able to hit something—like an airplane you'd rather not have flying around shooting at you. And the Pacific theater's strategy at the time was to load up the skies with shrapnel and hope to God that enemy craft ran into some of it. Unfortunately, this didn't prove to be any kind of effective, long-term means of conducting antiaircraft operations, and it sure tended to gobble up the ammo. Timing was everything. The guns had a muzzle velocity in excess of half a mile a second. Real fast. So if the gunner's trigger finger was off by even a second . . . well then, there went the bullet, whizzing harmlessly by that Nakajima Gekko half a mile away.

Van Allen and his brilliant cocreators tended to think outside the box, so the group took things one step further and came up with a way to have themselves a smart bullet. They built a dinky radio emitter that could with-

stand twenty thousand g-forces, and they capped it on top of a five-inch artillery shell. Van Allen himself was responsible for one of those back-of-a-napkin inspirational moments, cooking up an elegant way to protect the fine filaments inside the transmitter tubes from snapping after such an intense force. The final product emitted a continuous radio signal, and if the sensor sensed that it was getting close to something—like a troublesome Kawasaki Ki-61—then boom went the projectile. It was a hit, literally and figuratively, as the U.S. military scooped up the idea and sent it into production. Tens of *millions* were assembled and used with great success. Their effectiveness was estimated to be about five times better than plain old naked rounds. Van Allen spent months at sea training U.S. Naval crews; so by the time he walked aboard the *Glacier*, ships, sailing, ship ways, and even ship food were no big deal. “I was quite at home on ships, yes sir,” he said. He was even at home on this one, which featured no keel and commonly rolled twenty degrees in the lightest of winds.

Back in the *Glacier*'s sauna of a radio room, Van Allen took off the headphones and passed them to Larry Cahill. They'd walked up there together after a rather abysmal movie was shown over on the helicopter deck following dinner. Cahill was one of Van Allen's graduate students in the University of Iowa physics department. More prestigious-sounding institutions probably exist in which to chase a physics education. Van Allen was once directly asked why anyone should go to Iowa for this path of study, and there was no hesitation before his response, like he'd been asked a million times: “Physics work the same in Iowa City as they do anywhere else!”

David Armbrust shifted on his feet—the *Glacier*'s radioman was generally unaccustomed to such commotions and goings-on in his little world of a room way up here. But he knew there'd be a wave of visitors after he first heard the news. John Gniewek—a passenger on this trip who was ultimately headed to the nontouristy Antarctic to operate a magnetometer station there for the next year or so—then came in to find out what the latest was. Gniewek had found out about the occurrence around the same time as Cahill but wondered if Armbrust had been able to tune in the signal itself. He listened to the sweaty headphones passed to him, and what he heard was *beep-beep-beep-beep-beep*—short, staccato tones, a little like Morse code.

“Hey!” Van Allen blurted out. “Why don't we try and tape-record it?”

“Yeah,” Cahill agreed. The signal faded some, increasing the tension in the room. Everyone looked at Armbrust, who delicately massaged his gear and tuned it back in.

“We’ve got that Ampex recorder in the hold,” Van Allen began, then immediately stopped himself. True, they had a tape recorder way down in their lab with the rockets, but it was so god-awful heavy that they might not make it back up in time. It also would’ve been a shame to rip out all the wiring Cahill had already done for their telemetry system.

The signal faded again; Armbrust had to play with the dials some more to bring it back. An urgency came over the men. The beeping would surely be gone for good soon; nobody knew if it would return. They had to make a recording, to get a record of the signal, to find something that could do that. Gniewek spoke up—he had a portable recorder in his bunk and scampered off to get it. About the same time, Van Allen darted out of the radio room, hoofing it down to the lab after all. For a second, his eyes roamed the myriad stacks of gear, then he plucked out an oscilloscope and hauled it back up.

T plus nine minutes and counting. It had been nine minutes since Cahill and Van Allen had walked through the radio room door to peek at the news teletypes and Armbrust had turned to them saying, “I think that I have it!”

Van Allen strung out the cord to his machine, plugged in a few wires, and flicked the thing on. Tube electronics always take a minute to warm up. He crouched down and hovered over the gear, trying not to let any sweat drip on the mechanics. *Gosh it’s hot.* The small greenish circular screen finally pittered and then began displaying a graphical representation of the beeping. Within a minute Gniewek’s tape recorder was operational too, and it began laying down loop after loop of the curious tones. And then the beeps vanished. Gniewek squished both lips together and hit Stop, but his fingers hovered over the controls. Everyone in the room stayed glued to their respective equipment, not knowing for sure what would happen. They started stiffening up.

About an hour later, the beeps came back. Van Allen’s wide eyes went back to his scope, and Gniewek punched the recorder on again. They repeated that cycle once more before standing down their watch, moving the gear to one side, and finally settling down in the room to discuss what was

happening. By that time, the ship's captain, B. J. Lauff, had wandered up to join the impromptu gab session. His inquiry made Van Allen kick himself: *Jim, what about the Doppler shift? Was there any?*

Of course, that's why the signal kept fading!

Van Allen and the others jumped up and stood in front of the radio gear, back on full alert. "In order to keep the strongest signal, we kept continuously tuning it," he explained, "and I measured how much we had to tune it, from when going in to coming out." He jumbled some numbers on paper, scratching figures, based on a crude calibration of the radio dial and how much it had had to be adjusted each time in order to coherently reacquire the signals. *Add those, carry the two.*

Van Allen looked at his results and finally knew what they meant. "It checked very well with the velocity required to be in orbit." So he dashed out a telex, which Captain Lauff wired to the U.S. National Committee of the International Geophysical Year (IGY) in Washington DC:

USS GLACIER

IGY WASHINGTON DC

RECEIVED SIGNAL . . . BELIEVED RUSSIAN SATELLITE TRANSMITTER . . .

DISCOVERED BY DAVID ARMBRUST RM3 AND CONFIRMED AND RECORDED

BY IOWA SCIENTISTS . . .

For better or worse, it was *Sputnik*.