Lost Voices

The silence from the stars has never been tested against the one signal we could afford to hear

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A companion brief to the One Sky Alien Array research proposal · 6 October 2026

The claim

For sixty years, radio telescopes have pointed at nearby stars and heard nothing, and that silence has been read as a verdict: if anyone were broadcasting, we would know. That reading is wrong for the most plausible kind of broadcast. The searches were built to catch a steady tone. A powerful signal that reaches Earth briefly and repeats, five minutes a day or an hour a week, could never have been recorded as a detection by those searches, no matter how strong it was. For that class of signal, the silence is not evidence of absence. It is the sound of not having listened.

Three facts anyone can check

Fifteen minutes per star. The largest nearby-star surveys of the past decade observed each target for three five-minute scans inside half an hour, and most stars were observed once. A beacon that illuminates Earth for five minutes once a day shows up during about one percent of that cycle. For a beacon that repeats weekly, the figure is a sixth of a percent. The telescopes were not deaf. They were elsewhere.

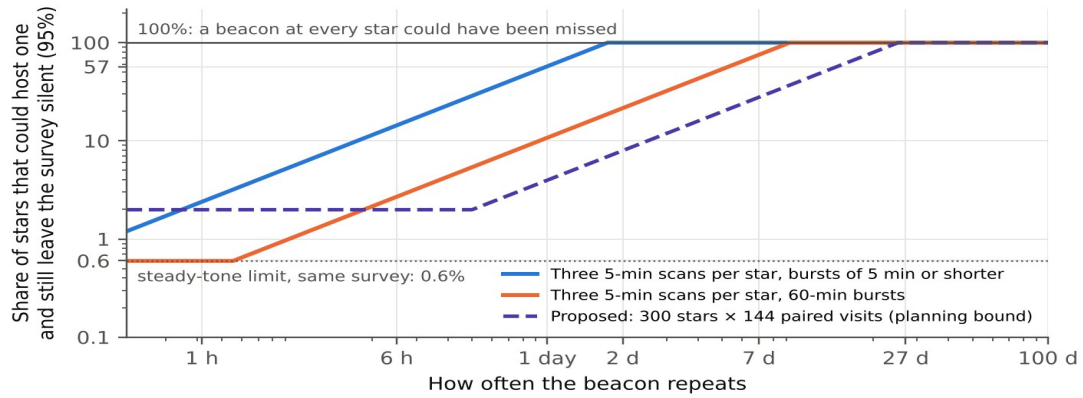
A rule that could not say yes. To count as a candidate, a signal had to appear in all three of those scans. A burst shorter than the gaps between them fails that rule by construction. No short, isolated burst, at any power, at any repetition period, could have passed into the published candidate lists. The nulls those surveys reported carry no information about such a signal at all.

Even on generous terms, the limits collapse. Suppose a search had accepted a signal seen in any single scan, and suppose it recovered half of what geometry allowed. In a survey of a thousand stars, the published-style limit on steady transmitters would be about 0.6 percent of stars. For a once-a-day five-minute beacon the same arithmetic gives 57 percent. For anything repeating less often than every day and three quarters, there is no limit at all: a beacon at every star in the survey is compatible with total silence. Beyond about a week, that outcome is the more likely one. And the half-recovery assumption is itself generous; the one group that measured end-to-end efficiency for pipelines of this kind found closer to thirteen percent.

Why this class of signal matters

A small radio dish cannot hear leakage, radar, or communication traffic from another star. A three-meter dish needs a transmitter delivering sixteen times the power of the Arecibo planetary radar toward Earth to notice a one-hertz tone at ten parsecs. The only thing it can hear is a beacon built to be heard, and the published analyses of what such a beacon would cost conclude that it would not be a steady tone: a transmitter minimizing cost per delivered detection sends powerful, directional pulses swept across many targets. The one signal class that inexpensive instruments can reach is the one class no survey has tested. That is not a coincidence to lament. It is an opening.

Figure 1 How much silence proves. A thousand-star survey, three five-minute scans per star, any single-scan detection accepted with 50 percent recovery; the dashed line is the proposed campaign, for the far more powerful beacons a small-dish network can hear. Geometry under ideal detection, reproduced by the full proposal's program.



What One Sky Alien Array proposes

First, an audit that costs nothing but time. Using only the timestamps in public Breakthrough Listen data, measure which beacon rhythms every observed star has and has not been covered for, and publish the result on a figure of merit comparable with the existing literature. If coverage turns out to be high, the project stops there and says so.

Second, a benchmark with locked rules. Inject synthetic bursts into real archive noise and test a short-window search against the standard pipelines, with acceptance rules, thresholds, and success margin registered publicly before any result is opened. Integrating a twenty-second burst over its own length rather than a five-minute scan gains a factor of about four in signal-to-noise; the question is what that gain costs in false alarms.

Third, and only if the first two justify it, a global ring of small stations. Pairs of dishes within an hour or two of longitude confirm each other and apply a computable Doppler test that separates a celestial source from anything fixed to the ground. The pairs are spread around the world because a single site, however it schedules, can never reach more than about a third of the phases of a once-a-day beacon, and because a fixed nightly schedule loses nearly all coverage at periods tied to the day. Completeness is expensive and the proposal says so: half coverage of a daily cycle costs 144 visits per star, roughly ninety nights of a ten-station network for three hundred stars. Every stage has a stop condition, and a stopped stage is a result.

What we are not saying

We are not saying anyone is transmitting. We are not saying small dishes can out-hear Green Bank; they cannot, by a factor of several thousand. The published limits on steady transmitters stand. We are saying something narrower and harder to dismiss: for the one kind of signal a cost-conscious civilization would plausibly send, and the one kind a worldwide network of modest dishes could plausibly hear, the record of the search so far is close to empty, and the arithmetic that shows it fits on a page.

The question is not whether anyone is out there. It is whether, for the one kind of signal we could afford to hear, we have ever really listened.

Derivations, tables, references, and the reproduction program are in the One Sky Alien Array research proposal of the same date, Sections 2, 6, and 7.