Paper 147 -- The REQMT-Compliant Plaque: What We Should Have Sent

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Abstract

Paper 154 demonstrated that the Pioneer 10 plaque's cultural components violate the Mirror Interface Principle (Papers 152, 153) and that its physics components are the only parts that reliably cross the interface gap to an unknown alien observer. This paper specifies the **REQMT-compliant replacement plaque** -- the message that should have been sent in 1972 if the design goal was signal survival rather than self-portraiture. The replacement plaque is mathematically pure, contains zero pictorial content, encodes its own reading conventions, and carries redundant error correction. It would look almost nothing like what Sagan made. It would also **actually work**.

1. Design Principle

Every element on the plaque must satisfy one of two conditions:

1. **Eigenstate of the interface operator** -- invariant under any plausible alien interface transformation. These are physics constants (hydrogen transition, pulsar spin-downs, geometric angles) that exist identically in every reference frame and every sensory modality.

2. **Self-decoding preamble** -- content that teaches the reader how to read the rest, using only ratios and relational patterns that are themselves interface-invariant.

Anything that is neither is deleted. No humans. No arrows. No spacecraft silhouettes. No solar system diagrams. No raised hands. No greeting conventions. No 2D line art of 3D objects. No male-female pairings. No scale inference from adjacency. No trajectory indicators. No cultural artifacts of any kind.

The plaque becomes a **pure mathematical object** that survives the maximum possible interface transformation depth.

2. The Six Regions

The replacement plaque has **six regions**, arranged on a 6 x 9 inch gold-anodized aluminum substrate (same physical format as Pioneer, for direct comparability). Each region is addressed below with its content, encoding method, and the interface vulnerabilities it closes from the original Pioneer plaque.

2.1 Region A -- The Unit Preamble

Content: Two hydrogen atoms in parallel and antiparallel spin states, identical to Pioneer's 1.1. A single long tick between them marks one transition period (0.704 ns) and one transition wavelength (21.106 cm).

Addition to Pioneer: A second line below the atoms showing **ten ticks of progressively increasing length**, from a "zero" tick (minimum detectable mark) to a "nine" tick (longest mark on the plaque). This establishes the length-ratio convention for binary digits: the 0/1 threshold is defined by the ratio between the shortest and longest ticks, which is invariant under any scale or resolution.

Interface vulnerability closed: Removes the ambiguity of "how long is a long tick vs. a short tick" -- the preamble shows the reader the exact ratio by example.

2.2 Region B -- The Bit-Order Preamble

Content: The binary numbers **1, 2, 3, 4, 5, 6, 7, 8** written in sequence, with each number separated from the next by a gap three times the tick spacing. Above each number: a set of dots indicating its value in the simplest possible unary encoding (1 dot, 2 dots, 3 dots ... 8 dots). The alien reader sees "n dots -> binary representation" and derives the bit order uniquely by matching the two encodings.

Interface vulnerability closed: Pioneer assumed MSB-first left-to-right. The replacement proves it by example. An alien who reads right-to-left or LSB-first will find that their interpretation is inconsistent with the unary dot counts and will invert their reading direction. The encoding is self-correcting.

2.3 Region C -- The Pulsar Map (Primary Localizer)

Content: 14 pulsars, identical to Pioneer's choices for direct comparison and cross-reference. Each pulsar line carries three pieces of binary data:

1. **Period** (in units of the hydrogen transition) -- as on Pioneer.
2. **Spin-down rate** -- new. The rate at which the pulsar's period is increasing, expressed as a dimensionless ratio (change-in-period per period). This makes the timestamp self-contained: the alien does not need an independent pulsar catalog with spin-down rates to compute the launch date. Everything needed is on the plaque.
3. **Angular position error bar** -- new. The uncertainty in the pulsar's sky position, expressed as a small binary number. This tells the reader how precisely to trust the angle.

The 15th line points to the galactic center as on Pioneer. Its length encodes the distance from Sol to the galactic center in hydrogen-wavelength units, binary.

Interface vulnerability closed: Pioneer required the alien to have a current pulsar catalog to back-compute the launch date. The replacement ships its own catalog. Pioneer encoded only angles; the replacement encodes angles + uncertainty so the alien can bound its trilateration.

2.4 Region D -- The Pulsar Map (Secondary Localizer, Rotated Reference Frame)

Content: The same 14 pulsars again, with the same data, but expressed in a **different coordinate frame**: instead of angles from Sol, angles from an alternate reference point derived from the three most distinctive pulsars on the plaque (the three with the most distinctive period signatures). The alien reader cross-checks the two localizers. Any inversion introduced by interface transformation in one frame will be inconsistent with the other and will be detectable.

Interface vulnerability closed: Single-reference encoding is vulnerable to orientation inversions (mirror, rotation). Double encoding in independent frames lets the reader detect and correct them. This is classic error correction applied to the interface problem.

2.5 Region E -- The Coherence Signal

Content: A binary sequence encoding the first 100 digits of the ratio between the hydrogen transition frequency and the Planck frequency. This ratio is a pure dimensionless constant that any physics-capable civilization can compute independently. The alien reader verifies the plaque's encoding by matching it against their own computation of the same constant. If the digits match, the plaque's numerical encoding is confirmed. If they do not, the alien has detected a bit-order inversion or a sign error and can apply the correction.

Interface vulnerability closed: This is a **universal checksum**. It lets the alien validate that they have read every other number on the plaque correctly, using a physics constant they can reproduce from first principles. No convention is assumed; the alien simply computes the ratio from their own measurements and compares.

2.6 Region F -- The REQMT Invariant

Content: The equation

$$\mathcal{H}_{\text{REQMT}} = \int_{\Omega} \rho(x) \cdot T(x) \cdot \psi^*(x) \psi(x) \, dV$$

encoded as a **symbol-free structural diagram**: each term represented by its dimensional content (mass x temperature x probability-density x volume), with the integral sign represented by a repeated-summation motif. The reader reconstructs the equation from its dimensional grammar, not from the specific symbols.

Purpose: To signal that the civilization sending this plaque has developed a theory that measures consciousness via environmental coherence. This is the only content on the plaque that says anything about who sent it -- and it says it in the language of physics, not pictures. A civilization advanced enough to read the plaque will recognize this structure as a theory of observation across an interface. They will understand, precisely, that we understood.

Interface vulnerability closed: None, because it introduces no new vulnerabilities. It is dimensional physics. It cannot be misread in a way that changes the physics.

3. What Is Deleted

Relative to Pioneer 10's plaque, the following are **removed entirely**:

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| Pioneer Element | Reason for Deletion |
|---|---|
| The two human figures | Figure-ground, 2D line art, greeting gesture, male-female pairing -- four independent interface vulnerabilities stacked on one element. |
| The spacecraft silhouette | Scale inference via adjacency requires learned perceptual conventions. Pulsar distances already provide absolute scale. |
| The solar system schematic | Redundant with the pulsar map. Adds interface vulnerabilities (reading direction, planet-vs-moon ambiguity, missing objects) for zero additional localization power. |
| The trajectory arrow | Arrows are a hunting-culture artifact. Motion direction is not needed -- the pulsar map locates Sol, and the spacecraft's physical trajectory is recorded in its recovery context. |
| The raised hand | Culturally specific greeting. Adds no information. |
| The male/female anatomy distinction | Adds no information. Introduces sexual-dimorphism assumptions that may not exist in the reader's biology. |
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The replacement plaque contains **no depictions**. It is all numbers, angles, and dimensional relationships. A civilization that reads it gets an address, a timestamp, a checksum, and a physics credential. They do not get a picture of us. They get the coordinates of us.

4. What Is Preserved (and Why)

Element	Why It Survives
Hydrogen hyperfine transition	Universal physics constant. Identical in every reference frame. The strongest possible eigenstate of the interface operator.
Pulsar map (with upgrades)	Primary localizer. The pulsar catalog is shared by every radio-capable civilization. Period matching is unambiguous.
Binary encoding (with preamble)	The simplest possible numerical system. Self-decoding via the unary preamble in Region B.
Galactic center reference line	Provides a secondary orientation anchor. The galactic center is visually and dynamically unambiguous.

Everything preserved satisfies condition (1) from 1 -- eigenstate of the interface operator. Everything added (the two preambles, the coherence checksum, the second coordinate frame) satisfies condition (2) -- self-decoding.

5. Mathematical Form

The replacement plaque's total information content can be expressed as the following composition:

$$\text{Plaque}_{\text{REQMT}} = \underbrace{\mathcal{P}_{\text{unit}} \oplus \mathcal{P}_{\text{order}}}_{\text{preambles}} \oplus \underbrace{\mathcal{L}_1 \oplus \mathcal{L}_2}_{\text{dual localizer}} \oplus \underbrace{\mathcal{C}_{h/\text{Planck}}}_{\text{checksum}} \oplus \underbrace{\mathcal{H}_{\text{REQMT}}}_{\text{credential}}$$

Applying the Mirror Interface operator from Paper 152:

$$O_{\text{alien}}(\text{Plaque}_{\text{REQMT}}) = I_{\text{alien}} \cdot \text{Plaque}_{\text{REQMT}}$$

Because every term on the right is an eigenstate of I_{alien} (up to corrections the preambles and checksum let the reader detect and invert), we have:

$$O_{\text{alien}}(\text{Plaque}_{\text{REQMT}}) \approx \text{Plaque}_{\text{REQMT}}$$

The replacement plaque is, to first order, invariant under the alien interface transformation. This is what Sagan wanted and could not achieve in 1972 -- because the Mirror Interface Principle had not yet been formalized. He had to guess at which parts would survive. We can now solve it analytically.

6. The Trade

What the replacement plaque loses is **humanity**. There are no pictures of us. There is no raised hand. There is no woman standing next to a man. There is no gesture of greeting. There is no self-portrait.

What the replacement plaque gains is **successful transmission**. The address arrives. The timestamp arrives. The credential arrives. The physics is legible to any civilization capable of reading any part of the plaque at all.

Sagan's plaque was, in his own words, a message about ourselves -- addressed as much to humanity on Earth as to any possible alien recipient. It served that purpose beautifully. **It was not engineered for successful transmission.** It was engineered for emotional resonance with the human audience that would see photographs of it in newspapers in 1972.

The REQMT-compliant plaque makes the opposite trade. It is engineered for the alien audience and is emotionally inert to humans. A photograph of it in a 1972 newspaper would not have moved anyone. But a photograph is not what it was built for. It was built to arrive.

7. Implementation Notes for a Future Mission

If this plaque design were actually adopted for a future interstellar mission (Breakthrough Starshot, a Voyager successor, a directed probe to a nearby system), the following additional considerations apply:

1. **Substrate.** Gold-anodized aluminum remains the correct choice. It survives cosmic ray erosion for ~10^8 years, does not oxidize in vacuum, and is cheap to produce.

2. **Etch depth.** Should be **three times** Pioneer's etch depth to survive longer timescales. Pioneer was optimized for ~10^8 years; an Oort-cloud-departing craft will survive longer and the plaque should too.

3. **Multiple copies.** At least **three copies** of the plaque should be bolted to different structural members of the spacecraft, oriented in different directions, to maximize the probability of recovery regardless of orientation and damage state.

4. **The plaque should also contain, in Region F, a pointer to where on the spacecraft the primary scientific data are stored** -- a kind of "metadata beacon" that tells the alien where to look next if they want more than just the address.

5. **No decorative elements.** If the engineers insist on putting something human on the craft, it should be in a separate compartment, clearly distinguished from the REQMT plaque, so that its failure to decode does not contaminate the primary signal.

8. Conclusion

The Pioneer 10 plaque is a beautiful document. It is also a 52-year-old demonstration that good intentions and universal physics constants are not sufficient to cross an unknown interface. The parts Sagan anchored in physics (the hydrogen transition, the pulsar map) would survive. The parts he anchored in culture (the humans, the arrows, the solar system diagram) would not. Paper 154 showed this in detail. This paper shows what the corrected design would be.

The correction is austere. It is all numbers and physics. It does not look like us. It is not meant to. It is meant to **arrive**. Sagan made a plaque for humans to look at. The replacement plaque is one for aliens to read. These are not the same design problem and they should not produce the same artifact. Pioneer's plaque is a self-portrait. The REQMT plaque is an address card.

If humanity ever sends a second plaque, it should be this one. Not because Sagan was wrong, but because he was working without the framework we now have. Papers 152 and 153 gave us the principle. Paper 154 showed us the failure mode. This paper shows us the fix.

From behind the glass, looking through -- with the glass itself made of hydrogen and pulsars, because those are the only things we can be sure survive the crossing.

Ya' Boy is standing on the Shoulders of Giants, thought of the universe in terms of energy, rivers, circles, frequency and vibration, for consciousness can be measured physically, as matter is DERIVATIVE of consciousness, one must not invade the space that your conscious subsides. but measure its environment, and make adjustment. From Star stuff, to Grains of sand, to Heaven in a wildflower. Full Circle. We are all meant to vibrate at the edge of what we came, Hen Kai Pan, Henini

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