

Silicon-Organic Photonics Goes to Space – Here's Where Glass Packaging Changes the Game

I Can See Clearly Now!

When NLM Photonics announced that its silicon-organic hybrid (SOH) photonic chips had reached the International Space Station as part of NASA's MISSE-21 mission, it marked a huge milestone for organic electro-optic (OEO) materials in space.



For the next year, those devices will be hammered by radiation, atomic oxygen, thermal cycling, vacuum, and UV – all so NASA and NLM can answer a fundamental question:

Can these high-performance organic photonic materials survive and stay stable in orbit?

Once the answer is “yes” (or “yes, under these conditions”), the next big challenge appears:

How do you package these devices into real, flight-ready modules for spacecraft, satellites, and eventually lunar infrastructure – without giving up their performance?

That's where ED2's **AGPT™ (Advanced Glass Packaging Technology)** can play a powerful role.

From Material Coupon to Flight Module: The Missing Layer

MISSE-21 is focused on **materials and device behavior** in space. But to field actual hardware, space programs still need:

- High-bandwidth RF interfaces to the modulators
- Robust, low-outgassing encapsulation for sensitive organics
- Thermal paths that work in vacuum
- Integration of RF, photonics, and digital logic in one compact module

AGPT is essentially that “missing layer” between NLM’s SOH chips and a fully integrated space photonics module.



How AGPT Helps NASA's Photonics Roadmap

Protecting Fragile OEO Materials in a Hostile Environment

Organic EO materials are the heroes of MISSE-21 – but they're also among the most sensitive components.

Glass-based AGPT modules can:

- Create **sealed glass cavities** over the SOH region, shielding organics from atomic oxygen and contamination
- Use **fused silica**, a proven space optical material, for excellent radiation and chemical stability
- Enable “**hermetic-lite**” structures that balance protection, mass, and cost

As MISSE-21 generates data on how Selerion-HTX™ and JRD1 behave in space, AGPT provides a logical next step: **turning bare die into robust, space-compatible photonic modules.**



Delivering Ultra-Low-Loss RF into Ultra-Fast Modulators

High-speed SOH modulators only reach their true potential if the RF path feeding them is equally advanced.

AGPT's fused-silica interposers offer:

- **Ultra-low-loss RF routing** into the mmWave / sub-THz bands
- Precise, impedance-controlled **coplanar and stripline structures**
- Very short, clean transitions from RF drivers into the modulator pads

Result: when NASA evaluates full transceiver modules (not just test coupons), they can measure the **real performance** of NLM's devices – not the losses of a legacy PCB.

3D Heterogeneous Integration on Glass

The future of space photonics is clearly **multi-die, multi-domain integration**:

- SOH modulators on silicon PICs
- Plasmonic chips
- RF driver/receiver ICs
- FPGAs / control ASICs
- Power management, telemetry, and health monitoring

AGPT is built for exactly this style of **3D heterogeneous integration (3DHI)**:

- Through-glass vias (TGVs) for vertical interconnect
- Fine-pitch redistribution layers (RDL) for dense routing
- A single glass module that brings RF, photonics, and compute together

That translates directly into **lower SWaP-C** (size, weight, power, cost) for NASA payloads and more compact, integrated architectures for future satellites and lunar infrastructure.

Smarter Thermal Management in Vacuum

Even “low-power” modulators and drivers can become hot spots in vacuum.

AGPT enables:

- Embedded **Cu “slab” planes and thermal vias** under high-power devices
 - Lateral heat spreading inside the glass package
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- Room for future **microfluidic or advanced thermal structures** in glass

For long-duration space missions, that means more predictable temperatures, less performance drift, and longer lifetimes – all from the packaging layer.

Fast Iteration and Dual-Use Commercialization

NASA increasingly prefers technologies that:

- Can be **iterated quickly** between flights
- Have strong **commercial pull** on the ground

AGPT was designed with that in mind:

- Wafer-level glass packaging → **fast design spins** for new layouts and experiments
- The same platform can support **datacenter optics, 5G/6G RF front-ends, and space photonics**, keeping costs and learning curves aligned with the commercial ecosystem.

Putting It All Together

NLM and NASA are answering a critical question at the materials level:

“Can silicon-organic hybrid photonics survive space?”

AGPT adds the next question:

“How do we package those materials into reliable, low-loss, space-ready modules that can actually fly?”

If you’re working on:

- Space photonics and optical comms
- High-speed RF front-ends for satellites
- Integrated RF-photonics or 3DHI for harsh environments

...then **glass-based packaging like ED2’s AGPT is a key piece of the puzzle.**

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www.ed2corp.com

info@ed2corp.com

