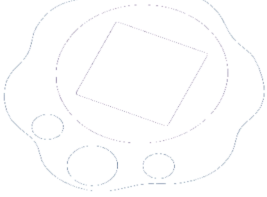

November 3, 2026 2026 年 11 月 3 日 Research 研究 Publication 出版物

Accelerating engineering for the physical world

加速面向物理世界的工程设计

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Today, we're sharing advances in how OpenAI models help engineers design, simulate, and build physical products. These capabilities span mechanical and electrical engineering and end-to-end system design, and are already helping our internal teams test ideas and iterate faster.

今天，我们将分享 OpenAI 模型如何帮助工程师设计、模拟和制造实体产品方面的进展。这些能力涵盖机械工程、电气工程和端到端系统设计，目前已帮助我们的内部团队测试想法并加快迭代。

Across these projects, engineers need to bring together mechanical designs, electronics, software, and manufacturing requirements using specialized tools. We're teaching models to support that work, from preparing drawings and setting up simulations to coordinating changes across disciplines. Our goal is to give engineers more time to explore ideas and improve designs.

在这些项目中，工程师需要借助专业工具，将机械设计、电子设备、软件和制造要求整合起来。我们正在训练模型来支持这项工作，涵盖从准备图纸、设置仿真到协调不同领域之间的变更。我们的目标是让工程师有更多时间探索创意、改进设计。

Over the past year, improved frontier model capabilities have helped our internal teams test new ideas and iterate faster, and we are seeing early evidence of these capabilities improving professional workflows in industry as well. We're working with collaborators to understand where these capabilities can make the biggest difference and what needs to improve. If you're an engineer, engineering firm, or software vendor involved in the design, simulation, manufacturing, or production of complex physical products, we'd love to work with you to shape this effort around the tools you use and the problems you need to solve.

过去一年，前沿模型能力的提升帮助我们的内部团队测试新想法并加快迭代，我们也已初步看到这些能力正改善行业中的专业工作流程。我们正与合作伙伴携手，了解这些能力能在哪些方面发挥最大作用，以及还有哪些需要改进。如果你是工程师、工程公司或软件供应商，参与复杂实体产品的设计、仿真、制造或生产，我们很期待与你合作，围绕你使用的工具和需要解决的问题共同推进这项工作。

Designing a device with Astra

使用 Astra 设计设备

We tested Astra's state-of-the-art performance in multimodal and computer use workflows by seeing if we can create a device without any direct human edits. To do this, we used GPT-6 to define the functional requirements and design the enclosure, printed circuit board (PCB), and software integrations needed to create a device users can use to talk to Codex.

我们通过测试 Astra 在多模态和计算机操作工作流中的领先表现，来验证能否在无需任何人工直接修改的情况下创建设备。为此，我们使用 GPT-6 定义功能需求，并设计外壳、印刷电路板（PCB）以及软件集成方案，从而打造一款用户可以用来与 Codex 对话的设备。

- **Aesthetics and design:** Astra developed the look of the device, drawing on our recent Work Louder collaboration and references from games and toys.

  美学与设计：Astra 为设备设计了外观，灵感源自我们近期与 Work Louder 的合作，以及游戏和玩具。

- **Mechanical design:** Astra designed the enclosure and the internal structures that hold the components in place.

  机械设计：Astra 设计了外壳及用于固定内部组件的结构。

- **Electrical design:** Astra selected the electrical components and designed the printed circuit board (PCB), including component placement and connections, to fit within the enclosure.

  电气设计：Astra 选定了电气元件，并设计了印刷电路板（PCB），包括元件布局和连接方式，以适配外壳内部空间。

- **UI/UX and software:** Astra designed the user interface and generated the firmware and software integrations needed to connect the device to Codex.

  用户界面与用户体验及软件：Astra 设计了用户界面，并生成了将设备连接到 Codex 所需的固件和软件集成方案。

Two team members designed this test device with Astra in under a week while working on it as a side project. A contract manufacturer built a small batch of prototypes in under a month.

两名团队成员将其作为副业项目，使用 Astra 在不到一周内设计出了这款测试设备。一家合同制造商在不到一个月内制作出了一小批原型。

Getting the device ready for manufacturing still required several rounds of review and iteration. Astra did not consistently account for the manufacturer’s production limits, tolerances, or details required for assembly. These gaps are helping us identify what future models need to do better.

为使设备满足生产要求，我们仍需进行多轮审核和迭代。Astra 未能始终将制造商的生产限制、公差或装配所需的细节考虑周全。这些不足正帮助我们明确未来的模型需要在哪些方面做得更好。

Accelerating OpenAI hardware teams

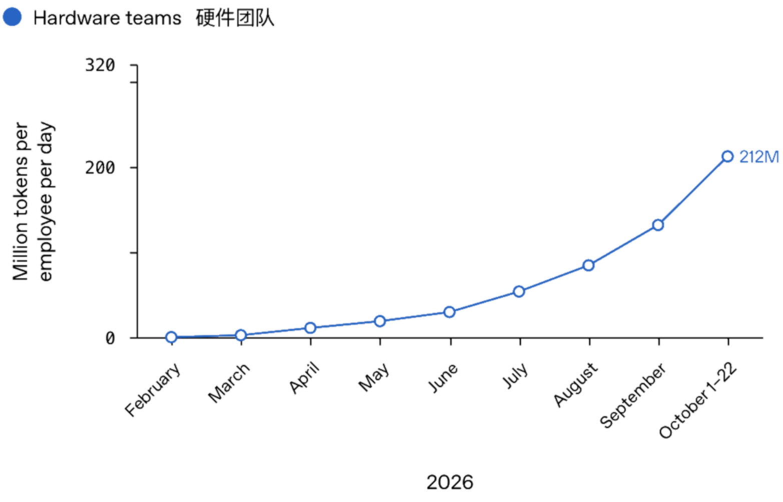
加速 OpenAI 硬件团队发展

OpenAI’s hardware and infrastructure teams use Codex and ChatGPT to create and revise computer-aided design (CAD) models, prepare manufacturing drawings, set up simulations, and review designs. This work spans robotics and compute infrastructure. Since February, model usage across our hardware teams, measured in tokens, has grown 23-fold.

OpenAI 的硬件和基础设施团队使用 Codex 和 ChatGPT 创建和修改计算机辅助设计（CAD）模型、准备制造图纸、设置模拟并审核设计。这些工作涵盖机器人技术和计算基础设施。自 2 月以来，我们硬件团队的模型使用量（以 token 数量衡量）增长了 23 倍。

Median daily Codex use across OpenAI hardware teams

OpenAI 硬件团队的 Codex 日均使用量中位数



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> *"Codex has dramatically accelerated how we move from an idea to an engineered part. We're iterating faster across CAD, converting 3D designs into production-ready 2D drawings, and setting up simulations and FEA with far less manual work."*
>
> *"Codex 大幅加快了我们从创意到工程零部件的推进速度。我们在 CAD 领域迭代得更快，能将 3D 设计转换为可投入生产的 2D 图纸，还能以少得多的手动操作来设置仿真和有限元分析（FEA）。"*

— Grace Lam, Forward Deployed Engineer at OpenAI

— Grace Lam，OpenAI 前线部署工程师

— Grace Lam, Forward Deployed Engineer at OpenAI	— Qiong Wang, Member of Technical Staff at OpenAI	— Jackie Lee, Member of Infrastructure Staff at OpenAI
— Grace Lam, OpenAI 前线部署工程师	— Qiong Wang, OpenAI 技术团队成员	— Jackie Lee, OpenAI 基础设施团队成员

Measuring progress on engineering tasks

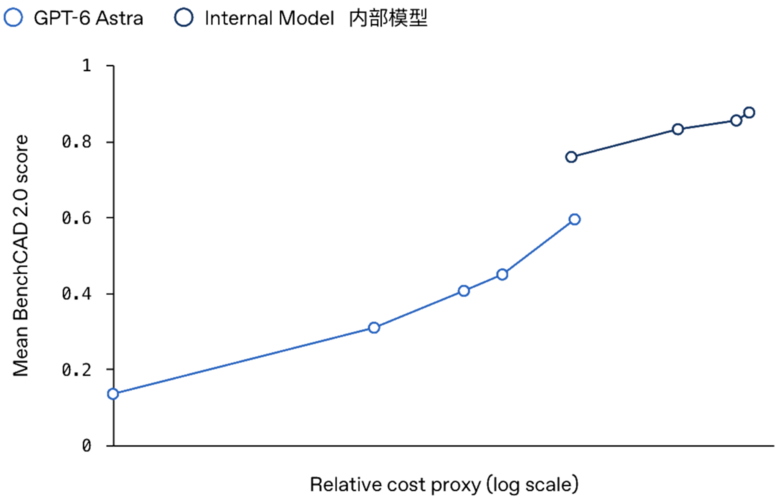
衡量工程任务的进展

We're also measuring progress in newer models on tasks that combine coding with engineering knowledge. BenchCAD 2.0 tests whether models can reconstruct 3D parts and assemblies and identify connections in circuit boards. A newer internal model achieved an average score of 0.875, compared with 0.594 for GPT-6 Astra at its highest reasoning setting. While the engineering lifecycle includes many other elements beyond design, we view improvements in capability here as early evidence of the ability of AI models to positively impact iteration speed for professional workflows.

我们也在衡量新一代模型在结合编程与工程知识的任务上的进展。BenchCAD 2.0 用于测试模型能否重建 3D 零件和组件，并识别电路板上的连接关系。一款较新的内部模型平均得分为 0.875，而 GPT-6 Astra 在最高推理设置下的得分为 0.594。尽管工程生命周期除了设计还包含许多其他环节，但我们认为模型在这方面能力的提升，是 AI 模型能够为专业工作流程带来积极影响、加快迭代速度的早期证据。

Performance of GPT-6 Astra and our Internal Model on BenchCAD 2.0

GPT-6 Astra 与我们的内部模型在 BenchCAD 2.0 上的表现



Safely deploying with industry collaborators

与行业合作伙伴协作，安全部署

We're working with a small group of industry collaborators to test these capabilities on real engineering problems. Their engineers review model outputs for accuracy and practical use, helping us understand which tasks models can support today and what needs to be improved for safe and reliable use.

我们正与一小部分行业合作伙伴合作，在实际工程问题中测试这些能力。合作伙伴的工程师会审核模型输出的准确性和实用性，帮助我们了解当前模型能够支持哪些任务，以及要实现安全可靠的应用还需要哪些改进。

We're expanding our collaboration with Chip Ganassi Racing (CGR) to explore how OpenAI models can accelerate engineering and prototyping. Working with its R&D team, we're testing workflows that turn 3D scans of existing parts into editable CAD models and 2D manufacturing drawings. This is particularly useful when the original design files are unavailable.

我们正在拓展与 Chip Ganassi Racing（CGR）的合作，探索 OpenAI 模型如何加速工程设计和原型制作。我们与其研发团队合作，测试如何将现有零件的 3D 扫描数据转化为可编辑的 CAD 模型和 2D 制造图纸。当原始设计文件不可用时，这项技术尤其有用。

CGR engineers review the models and drawings for accuracy and manufacturability. Their feedback helps us identify where models can reduce manual work and where further improvements are needed.

CGR 工程师会审核模型和图纸，确保其准确性和可制造性。他们的反馈帮助我们发现模型在哪些方面可以减少人工操作，以及哪些地方还需要进一步改进。

> *"The model has been useful for going from raw scan data to a solid body. I have been working with Codex directly in CAD. The feedback I give the model is directly applied, the manual tweaks can be made directly, and this has become a faster, more hands-off process for me."*
>
> **这个模型在将原始扫描数据转化为实体方面很有用。我一直在 CAD 中直接使用 Codex。我给模型的反馈会被直接应用，也可以直接进行人工调整，这让整个流程对我来说更快、更省心。"**
>
> — Matthew Ortman, R&D Engineer at Chip Ganassi Racing
>
> — Matthew Ortman，Chip Ganassi Racing 研发工程师

We're also announcing a new research collaboration with Mazda. Our research and Forward Deployed Engineering teams are working with Mazda's aerodynamics and crash-safety engineers to explore how OpenAI models can help develop and evaluate new vehicle designs.

我们还宣布与马自达开展一项新的研究合作。我们的研究团队和前沿部署工程团队正与马自达的空气动力学和碰撞安全工程师合作，探索 OpenAI 模型如何助力开发和评估新的汽车设计。

The work uses simulations of airflow and structural behavior to explore improvements in performance while accounting for styling and cost. We'll share more progress and results in the coming months.

这项工作利用气流和结构行为模拟，在兼顾造型与成本的同时，探索提升性能的方法。未来几个月，我们将分享更多进展和成果。

GPT-6 Astra helps Mazda's aerodynamics engineers explore ways to reduce vehicle drag by modeling new nose shapes, simulating airflow, and refining the most promising designs. Agreement for use has been obtained from Mazda Motor Corporation. Any republication or reuse elsewhere is strictly prohibited.

GPT-6 Astra 助力马自达的空气动力学工程师探索降低车辆风阻的方法，包括建模设计新的车头造型、模拟气流，以及优化最具潜力的设计。相关使用已获得马自达汽车株式会社授权。严格禁止在其他地方转载或重复使用。

> *"Does it have to look like that?" Our designers often ask us when we find a shape that improves airflow. By exploring and simulating dozens of variations, Astra in Codex helps us understand which features matter for aerodynamics and where designers have room to explore. That's why the value of Astra and collaborating with OpenAI goes beyond task automation and shortening development cycles: it is helping us bring together Mazda's distinctive design and aerodynamic performance without treating either as a compromise."*
>
> **"它非得长成这样吗？"当我们发现某种形状有助于改善气流时，设计师常常会这样问我们。通过探索和模拟数十种不同方案，Codex 中的 Astra 能帮助我们了解哪些特征对空气动力学至关重要，以及设计师有哪些发挥空间。这正是 Astra 和与 OpenAI 合作的价值不止于自动化任务、缩短开发周期的原因：它帮助我们将马自达独特的设计风格与空气动力学性能融为一体，而不必牺牲其中任何一方。"**
>
> — Akihiro Nakata, Principal Engineer at Mazda
>
> — Akihiro Nakata，马自达首席工程师

Help shape AI for engineering and manufacturing

共同塑造面向工程与制造业的 AI

We have been working closely with industry partners and early adopters to push the bounds of what we can do with AI agents in hardware and manufacturing. These early results have shown exciting promise, and we’re now looking for collaborators to accelerate these capability improvements and ensure we deploy these safely into industry.

我们一直与行业合作伙伴和早期采用者密切合作，探索 AI 智能体在硬件和制造领域的能力边界。这些早期成果展现出令人振奋的潜力。如今，我们正在寻找合作伙伴，共同加速提升这些能力，并确保将其安全地应用于工业领域。

If you are interested in working with us to shape the training and development of our frontier models by identifying high-value use cases, software tooling, or future opportunities in mechanical engineering, electrical engineering, electromechanical design, mechatronics, or a related field, please fill out this form and we'll be in touch.

如果您有兴趣与我们合作，通过发掘高价值用例、软件工具
程、电气工程、机电设计、机电一体化及相关领域的未来机
造我们前沿模型的训练与发展，请填写此表格，我们会与您

人在草木间
更多资料请加V！