AI Infrastructure 人工智能基础设施

Exclusive: SpaceX Lays Groundwork For Turbine-Blade Factory to Solve Data Center Power Crunch

独家报道：SpaceX 为涡轮叶片工厂奠定基础，旨在解决数据中心电力短缺问题

SpaceX CEO Elon Musk and a GE Vernova gas turbine part. Photos via Getty Images.

SpaceX 首席执行官 Elon Musk 与通用电气 Vernova 燃气轮机部件。图片来自 Getty Images。



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Elon Musk intends to bypass the power supply chain for AI data centers in a way others assumed was impossible, by making highly complex components himself.

Elon Musk 打算通过自行制造高度复杂的组件，以一种他人认为不可能的方式，绕过 AI 数据中心的电力供应链。

It's a move no one else has been bold enough to attempt.

这是一个无人敢于尝试的大胆举动。

SpaceX has taken steps to develop a foundry in Bastrop, Texas, about 30 miles from Austin, to make vanes and blades for large gas turbines, according to job listings and other indicators.

根据招聘启事和其他迹象显示，SpaceX 已采取措施在德克萨斯州巴斯特罗普（距离奥斯汀约 30 英里）建立一家铸造厂，用于生产大型燃气轮机的导向叶片和动叶片。

Update: After this story was published, Musk confirmed the reporting by tweeting that despite large investments in solar energy, "natural gas will still be needed to supplement and bootstrap solar for several years. By doing in-house casting [of blades and vanes] at SpaceX, we can accelerate nat gas turbines coming online by up to 18 months, which is a profound game-changer."

更新：本文发布后，马斯克通过推文证实了这一报道。他表示，尽管在太阳能领域投入了巨资，"但在未来几年内，仍需要天然气来补充和引导太阳能的发展。通过在 SpaceX 内部进行[叶片和导向叶片的]铸造，我们可以将天然气轮机的上线时间缩短多达 18 个月，这将是一个意义深远的变革。"

In recent months, SpaceX advertised that it is seeking a senior operations engineer "to serve as the extreme owner of the construction, buildout, and operational ramp-up of a new blades and vanes foundry." It has sought a senior materials engineer, an automation engineer, a senior tooling engineer to design castings.

近几个月来，SpaceX 发布广告招聘一名高级运营工程师，"作为新建叶片和导向叶片铸造厂的建设、扩建和运

营提升的最高负责人”。此外，该公司还招聘了高级材料工程师、自动化工程师以及负责设计铸件的高级模具工程师。

SpaceX also says it is looking for a programmer to assist in the milling of parts in high-temperature superalloys at “SpaceX’s new industrial gas turbine (IGT) blades and vanes manufacturing line in Bastrop,” the Austin-area location.

SpaceX 还表示，正在寻找一名程序员，协助在位于奥斯汀地区的“**SpaceX** 巴斯特罗普新工业燃气轮机（**IGT**）叶片和导向叶片生产线”进行高温超合金零件的铣削工作。

Morgan Stanley analyst Adam Jonas says his research also shows Musk is developing such a plant.

摩根士丹利分析师 **Adam Jonas** 表示，他的研究也表明 **Musk** 正在筹建这样一家工厂。

Until now, a global oligopoly of four casting companies has tightly controlled production of these vanes and blades, engineered for ultrahigh heat of 3,000 to 3,600 degrees Fahrenheit, 800 degrees above their own melting point. The maxing out of their foundries is a key reason large

turbine makers like GE Vernova are sold out until 2030 and why the AI building boom is short on power.

在此之前，全球由四家铸造公司组成的寡头垄断集团一直严密控制着这些导向叶片和动叶片的生产。这些叶片专为 3,000 至 3,600 华氏度的超高温环境设计，比其自身熔点还要高出 800 度。这些铸造厂的产能达到极限，是 GE Vernova 等大型涡轮机制造商的订单排到 2030 年的主要原因，也是 AI 建设热潮面临电力短缺的关键所在。

'The Limiting Factor' “限制因素”

Musk previously stated in a February podcast that blades and vanes are “the limiting factor” to faster provisioning of turbines and ultimately to standing up data centers. (Blades are also known to crack under stress running volatile AI workloads, so having a few extras handy might be helpful.)

Musk 此前在 2 月份的一次播客中表示，叶片和导向叶片是加快涡轮机供应、并最终建立数据中心的“限制因素”。（众所周知，叶片在运行波动剧烈的 AI 工作负载压力下容易产生裂纹，因此手头有一些备件可能会很有帮助。）

At the current production rate, Musk said, “it’s not clear to

me that there's enough usable electricity to turn on all the AI chips that are being made."

马斯克表示，按照目前的生产速度，“我不确定是否有足够的可用电力来启动所有正在制造的 AI 芯片。”

His prognostication continues to prove accurate, as we have been chronicling in this column week after week.

正如我们每周在本专栏中所记录的那样，他的预言正不断被证明是准确的。

If he succeeds in making the parts and using them to build or refurbish more turbines, Musk could potentially build some of the 10 gigawatts or more of terrestrial data centers he has told SpaceX investors he could put up by the end of 2027.

如果他能成功制造出这些零部件并将其用于建造或翻新更多涡轮机，马斯克就有可能建成他在 SpaceX 投资者会议上提到的、到 2027 年底前投产的 10 吉瓦或更大规模的地面数据中心。

Musk said earlier this month that he had secured Nvidia chips for these future sites, and AI cloud providers I spoke

with argued that he has the capital and gall to bootstrap his way to power.

马斯克本月早些时候表示，他已经为这些未来的站点锁定了英伟达芯片。与我交流过的 AI 云服务提供商认为，他拥有足够的资金和胆量，能够通过自力更生的方式解决电力供应问题。

SpaceX shares plunged after the call on fears about what it would all cost. Debates continued to rage between traditional energy experts who asserted that powering hyperscale data centers off grid is far harder than it looks and AI bulls like Dylan Patel of research and investment firm SemiAnalysis, who stated his belief that Musk could pull it off.

在电话会议结束后，由于担心相关成本，SpaceX 的股价大幅下跌。争论在传统能源专家和 AI 看多者之间持续升温：前者断言，为超大规模数据中心提供离网供电的难度远超想象；而后者，如研究与投资机构 SemiAnalysis 的 Dylan Patel，则表示相信马斯克能够成功。



“This is because you have no idea how to build infrastructure,” Jigar Shah, a clean energy and p entrepreneur who ran President Biden’s energy loan office

shot back at Patel on X.

“这是因为你根本不知道如何建设基础设施，”曾负责拜登总统能源贷款办公室的清洁能源与电力企业家 Jigar Shah 在 X 平台上对 Patel 反唇相讥道。

Musk’s potential to unlock even more fossil fuel power for AI data centers would represent a setback to low-carbon energy advocates who had hoped the supply crunch for turbines would encourage renewables. BloombergNEF has estimated that if planned off-grid gas plants for data centers come to fruition, they would boost U.S. carbon dioxide emissions 20%. That figure wouldn’t include Musk’s latest efforts, but it would count 2 GW of off-grid gas deployments that SpaceX’s xAI unit has said will be running by the end of the year at its data centers in the Memphis, Tenn., area.

马斯克挖掘更多化石燃料电力用于 AI 数据中心的潜力，对于那些希望涡轮机供应短缺能推动可再生能源发展的低碳能源倡导者来说，无疑是一个挫折。据 BloombergNEF 估计，如果计划中为数据中心建设的离网燃气电厂得以实现，将使美国的二氧化碳排放量增加 20%。这一数字尚未包括马斯克的最新举措，但已计入 SpaceX 旗下 xAI 部门声称将于年底前在田纳西州孟菲斯

地区数据中心运行的 2 GW 离网燃气部署。

Dual Use

It couldn't be learned where he is seeking to locate his new data centers, but Grace reported last month that Musk was laying the groundwork for a major facility in Texas, where he also has plans in various stages for a massive chip foundry and solar panel manufacturing complex. He has also said he would expand facilities in the Memphis area.

目前尚无法获知他计划将新数据中心设在何处，但 Grace 上个月报道称，马斯克正为在德克萨斯州建设一座大型设施奠定基础，他在该州还有处于不同阶段的巨型芯片代工厂和太阳能电池板制造综合体计划。他还表示将扩大在孟菲斯地区的设施。

Morgan Stanley's Jonas believes SpaceX is standing up a Texas turbine-component foundry for both its data center needs and its Raptor turbopumps, vital internal components of the company's rocket engines.

摩根士丹利的 Jonas 认为，SpaceX 正在德克萨斯州建立一个涡轮机部件铸造厂，既是为了满足其数据中心的需求，也是为了生产其 Raptor 涡轮泵——这是该公司火箭

泵，也是为了生产其 Raptor 涡轮泵——这是该公司火箭发动机至关重要的内部组件。

“Raptor turbopump castings and data center turbine airfoils draw on the same alloys, furnaces and trained workforce, letting a single foundry spread fixed cost across the space and AI businesses,” Jonas said in a report this month.

Jonas 在本月的一份报告中表示：“Raptor 涡轮泵铸件和数据中心涡轮叶片使用相同的合金、熔炉和受过培训的劳动力，这使得单一铸造厂能够将固定成本分摊到航天和 AI 业务中。”

To be sure, nailing the casting process to replicate what leaders like Precision Castparts have done for decades isn’t easy and could take years. But it’s critical to SpaceX’s relatively recently adopted quest to become a cloud provider on par with today’s incumbents.

诚然，要攻克铸造工艺以复制像 Precision Castparts 这样的行业龙头数十年来的成就并非易事，可能需要数年时间。但对于 SpaceX 而言，这对于其近期致力于成为与现有巨头并肩的云服务提供商的追求至关重要。

Getting Turbines 获取涡轮机

In the interim, Musk is working to access several gigawatts of bridge power in the also-scarce market for smaller turbines. Jonas said Musk could access about 3 to 4 GW of power by the end of 2027 through a mix of purchase agreements.

在此期间，马斯克正努力在同样稀缺的小型涡轮机市场中获取数吉瓦（GW）的过渡电力。Jonas 表示，通过一系列采购协议，马斯克到 2027 年底有望获得约 3 到 4 吉瓦的电力。

In recent months, Musk has worked quietly to source turbines with Wall Street hedge fund Fortress Investment Group, which has invested in at least two separate suppliers.

近几个月来，马斯克一直与华尔街对冲基金 Fortress Investment Group 秘密合作采购涡轮机，该基金已投资了至少两家不同的供应商。

A SpaceX facility (in background) at Elon Musk's Snailbrook town in Bastrop, Texas. Photo by Brandon Bell/Getty Images

位于德克萨斯州巴斯特罗普县埃隆·马斯克的 Snailbrook 小镇的一处 SpaceX 设施（背景）。照片由 Brandon Bell/Getty Images 拍摄。

Fortress sold a supplier of mobile industrial turbines, APR Energy, to Musk personally, according to a Federal Trade Commission filing in May. APR said in January it had about 1 GW of turbines in its fleet, suggesting they would become available to Musk.

根据联邦贸易委员会 5 月份的一份文件，Fortress 将一家移动工业涡轮机供应商 APR Energy 出售给了马斯克个人。APR 在 1 月份表示，其机队拥有约 1 GW 的涡轮机，这表明马斯克将可以使用这些设备。

SpaceX may also be purchasing turbines from FTAI Aviation, which modifies and refurbishes the machines for commercial aircraft engines. FTAI, spun out from another Fortress portfolio company, announced a $1.465 billion turbine sale in July via its Chinese joint venture partner to "a leading international cloud services provider." Jonas has identified FTAI as a possible supplier to SpaceX.

SpaceX 可能还在从 FTAI Aviation 购买涡轮机，该公司负责为商用飞机发动机改装和翻新机器。FTAI 是从 Fortress 的另一家投资组合公司拆分出来的，该公司在 7 月份宣布，通过其中国合资伙伴向"一家领先的国际云服务提供商"出售了价值 14.65 亿美元的涡轮机。Jonas 已将 FTAI 确定为 SpaceX 的潜在供应商。

The Bastrop foundry plans are relatively new. SpaceXAI already operates a factory there, related to its Starlink satellite business, but between March and June it bought about 830 nearby acres, according to Corey Trinetti, a due diligence specialist who publishes detailed reviews of AI infrastructure sites in his newsletter, Measured AI. Two newly developed buildings adjacent to the Starlink factory that were not there a year earlier appeared in satellite imagery in July.

巴斯特罗普铸造厂的计划相对较新。SpaceX 已经在那里经营着一家与其 Starlink 卫星业务相关的工厂，但据尽职调查专家 Corey Trinetti 称，在 3 月至 6 月期间，该公司购买了附近约 830 英亩的土地，他在其简报《Measured AI》中发布了关于 AI 基础设施站点的详细评论。7 月份的卫星图像显示，Starlink 工厂附近出现了两座一年前还不在此处的落成建筑。

Trinetti was unable to find foundry permits or construction filings in Texas environmental or building records, however, so it isn't clear whether SpaceX has started a permitting process.

然而，Trinetti 在德克萨斯州的环境或建筑记录中未能找到铸造厂许可或施工备案，因此目前尚不清楚 SpaceX 是否已启动许可申请流程。

Musk already stunned the data center industry once by completing the Colossus data center in Memphis in record time two years ago. It wasn't the highest-quality facility, to be sure, but SpaceX is now making a lot of money from renting it out to Anthropic.

两年前，马斯克以创纪录的速度完成了位于孟菲斯的 Colossus 数据中心，令整个数据中心行业为之震惊。诚

然，那并非设施质量最高的中心，但 SpaceX 现在通过将其租给 Anthropic 赚取了大量利润。

He’s trying to do it again with power, and betting against him is usually a risky strategy.

他正试图在电力领域重演这一奇迹，而押注他会失败通常是一项风险极高的策略。