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SHAPING THE FUTURE OF AEROSPACE

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DEPARTMENTS

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SpaceX

Putting Starship's plasma in perspective

The millions who watched the Starship test flight online last month witnessed a well-known phenomenon in a new way.

As the vehicle dug into the atmosphere base first, a glow appeared and began to grow. It was plasma, a mix of electrons and ions created as Starship plowed into the atmosphere at 8 kilometers per second, generating enormous heat that broke molecules apart and ripped electrons from their atoms.

Plasma forming around a spacecraft on the way home is nothing new. It was the view that captivated viewers, among them space historians.

"There's never been live footage of plasma completely enveloping a reentry vehicle, except from very far away," said Matthew Hersch, an associate professor at Harvard University who specializes in the history of technology, by email. Fellow historian Michael J. Neufeld, a former curator of the Smithsonian Institute's National Air and Space Museum, was also taken aback: "I watched that live, and I was fairly amazed," he said.

The scene was captured by a camera outside Starship on one of its nose flaps, streamed up to SpaceX's Starlink constellation and onto X. The exterior view, and the livestreaming, were unique.

"Reentry has been extensively photographed, filmed, or videotaped from inside a reentry vehicle, but only for later viewing," Hersch said. As the New York Times noted, Varda Space Industries, a California company that makes commercial reentry vehicles, in February shared a video of plasma outside one of its capsules.

Usually, plasma quickly blocks radio transmissions from a space vehicle, causing the infamous blackout period that mission controllers must endure until a vehicle slows enough that the plasma subsides and the link can be restored. In this case, viewers enjoyed 2 minutes and 20 seconds of the plasma shifting about as Starship maneuvered. It was mesmerizing, almost tranquil, but one of the SpaceX narrators placed the entry temperatures at 2,600 degrees Fahrenheit (1,400 Celsius).

How did this transmission persist so long? Livestream narrator Siva Bharadvaj, a space operations engineer, provided a clue early in the livestream when he previewed the coming moments. Starship, he said, is so big that it will leave a "wake" through the atmosphere. The implication was that the video might continue streaming, and indeed it did — for a while. The transmission finally broke at an altitude of 75 kilometers over the Indian Ocean, though SpaceX continued to get some telemetry data to an altitude of 65 kilometers. SpaceX later announced that the vehicle was lost. ★

— Cat Hofacker and Ben Iannotta