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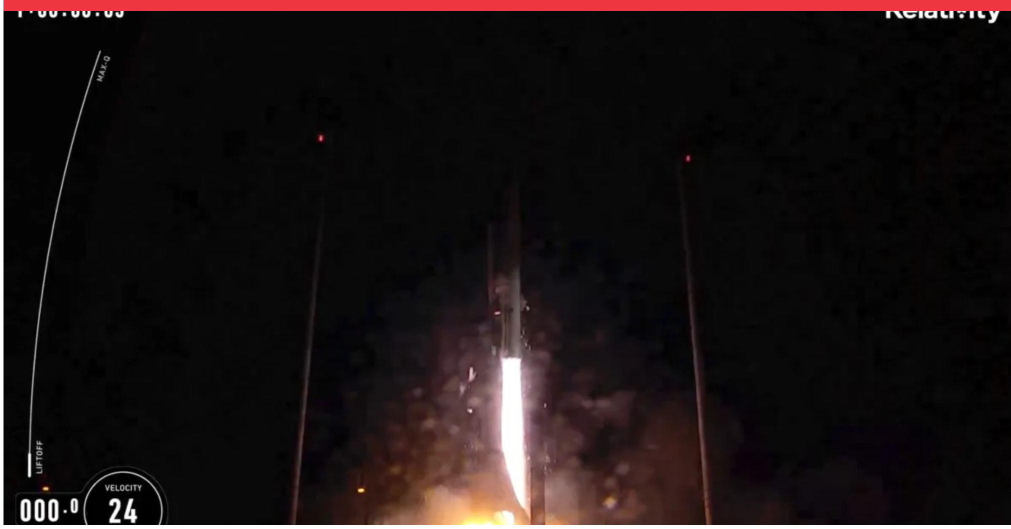

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Relativity Launches First Terran 1

Relativity Space's first Terran 1 rocket successfully got off the launch pad March 22 but failed to reach orbit because of an upper stage malfunction.

The Terran 1 rocket lifted off at 11:25 p.m. Eastern from Launch Complex 16 at Cape Canaveral Space Force Station in Florida on a test flight dubbed "Good Luck, Have Fun" by the company. Liftoff was delayed by nearly 90 minutes because of upper-level winds as well as a boat that strayed into restricted waters. The rocket's first stage, powered by nine Aeon 1 methane-fueled engines, appeared to operate as planned, passing through the region of maximum dynamic pressure known as "Max-Q" 80 seconds after liftoff. Getting through Max-Q was a major goal for this launch to demonstrate the integrity of the rocket's 3D-printed structure.

Stage separation took place 2 minutes and 45 seconds after liftoff, and the rocket's single Aeon Vacuum upper stage engine ignited. However, footage from a camera on the stage showed the plume flickering seconds after ignition, and telemetry on the company's webcast of the launch indicated the vehicle was slowing. Mission control declared an anomaly with the upper stage five minutes after liftoff, but didn't immediately disclose additional details about the failure.

Despite failing to reach orbit, the company was pleased with the performance of the earlier phases of flight. Before the launch the company emphasized that simply getting through Max-Q would be a major milestone. "This will essentially prove the viability of using additive manufacturing tech to produce products that fly," wrote Tim Ellis, chief executive and co-founder of Relativity, in a series of tweets before the first launch attempt. The rocket did not carry a satellite payload, only a small 3D-printed component from the company's first printer.

"Although we didn't reach orbit, we significantly exceeded our key objectives for this first launch, and that objective was to gather data at Max-Q, one of the most demanding phases of flight, and achieve stage separation," said Arwa Tizani Kelly, technical program manager for test and launch at Relativity, during the webcast. "Today's flight data will be invaluable to our team as we look to further improve our rockets, including Terran R."
Terran R is a much larger, fully reusable launch vehicle that Relativity is developing for a first launch as soon as 2024. Terran 1, which can place up to 1,250 kilograms into orbit, is a technology pathfinder for Terran R, with a payload capacity of about 20,000 kilograms.

Relativity scrubbed its first Terran 1 launch attempt March 8 because of a problem with ground systems that were unable to get liquid oxygen propellant in the rocket's upper stage to the right temperature. The company tried again three days later only to abort two countdowns during a three-hour window, one because of a sensor reading just 0.5 seconds before liftoff and the other because of a drop in fuel pressure in the upper stage at T-45 seconds.

The company was able to correct both problems but had to work around airspace limitations on the Eastern Range during the busy spring break travel season. Moving from an afternoon launch window, used for the first two launch attempts, to one at night reduced airspace conflicts. Relativity did not announce plans before the launch when, or even if, they would perform another Terran 1 launch. Before the first launch attempt, Ellis suggested the company might skip ahead to Terran R even if the launch failed, depending on the feedback the company got from its customers. "Do they want us to continue down the path of producing more Terran 1's to solve for those issues on this vehicle? Or, would like us to solve the remaining rocket science problems on the vehicle they are actually most interested in, Terran R? " Read the article here.

Nickel/Cobalt & Stainless-Steel Flat Rolled Surcharges

	Dec	Jan	Feb	Mar	Apr	May	June
15-5	1.0176	1.1326	1.1856	1.2015	1.1219	*	*
17-4	1.0321	1.148	1.2011	1.2168	1.1359	*	*
17-7	1.1528	1.3023	1.3454	1.3272	1.2054	*	*
201	0.8539	0.9422	0.968	0.9618	.8985	*	*
301 7.0%	1.1225	1.268	1.3099	1.2923	1.1756	*	*
302/304/304L	1.2452	1.4096	1.4562	1.4342	1.2970	*	*
304-8.5%	1.3002	1.474	1.5231	1.4991	1.3517	*	*
305	1.6914	1.9319	1.9977	1.9593	1.7408	*	*
309	1.7365	1.9765	2.0414	2.0026	1.7830	*	*
310	2.5319	2.9047	3.0029	2.9352	2.5730	*	*
316/316L	1.8226	2.1115	2.3468	2.4610	2.2319	*	*
321	1.3484	1.5304	1.5841	1.5565	1.3997	*	*
347	1.6518	1.8353	1.8868	1.8607	1.7033	*	*
409/409 Mod	0.2774	0.2894	0.3007	0.3111	0.3387	*	*
410/410S	0.2819	0.2951	0.3046	0.3162	0.3432	*	*
430	0.3399	0.3525	0.3609	0.3719	0.3975	*	*
439	0.3609	0.3713	0.3822	0.3908	0.4166	*	*
263	10.7724	10.9832	10.8442	11.7846	13.2813	12.3785	11.6182
276	9.5601	10.1487	10.0837	11.153	13.5698	14.5412	14.9952
A286	3.1578	3.194	3.0092	3.4243	4.0143	4.0365	3.8984
600	7.6239	7.8565	7.4646	8.7808	10.2636	10.0981	9.4687
601	6.3546	6.4998	6.1684	7.2046	8.3839	8.2504	7.7529
617	10.019	10.3713	10.2334	11.3131	13.1396	12.9453	12.5807
625	9.8369	10.2096	10.0402	11.1493	13.0263	13.4647	13.444
718	8.8356	9.0313	8.7834	9.713	11.0007	11.0906	10.8266
X-750	8.0417	8.2187	7.8343	9.0694	10.4613	10.3044	9.706
800	3.5491	3.5905	3.3695	3.8869	4.5042	4.4588	4.2056
825	5.0611	5.1995	5.0087	5.6952	6.7372	6.8800	6.7479
HX	6.8404	7.1842	7.0661	7.9429	9.6011	10.0649	10.1612
188	14.6262	14.555	14.287	14.5401	14.9566	12.1294	10.4308
L-605	15.6932	15.5614	15.3483	15.396	15.5962	12.1584	10.2033

*Surcharge currently not available

Nickel/Cobalt & Stainless-Steel Bar Surcharges

	Jan	Feb	Mar	Apr	May	June
316LS/316LVM	3.59	3.74	3.77	3.35	*	*
Custom 455	2.18	2.02	1.94	1.80	*	*
Custom 465	3.18	2.91	2.88	2.63	*	*
Custom 630	1.41	1.43	1.38	1.33	*	*
CCM	17.72	14.34	12.34	12.61	*	*
625	14.44	14.37	14.45	12.67	*	*
718	11.33	10.87	10.71	9.48	*	*
718CR	11.33	10.87	10.71	9.48	*	*
A286	5.83	5.45	5.30	4.73	*	*
A2861	5.83	5.45	5.30	4.73	*	*
A2862	5.83	5.45	5.30	4.73	*	*
A2867	5.83	5.45	5.30	4.73	*	*
A286R1	5.83	5.45	5.30	4.73	*	*
A286SH	5.83	5.45	5.30	4.73	*	*
Wasp6	14.58	13.56	12.82	11.53	*	*
L605	16.76	13.81	12.10	12.41	*	*
321	2.37	2.35	2.25	2.06	*	*
347	2.37	2.35	2.24	2.05	*	*
Greek Ascaloy	1.45	1.47	1.49	1.49	*	*

*Surcharge currently not available

Titanium Surcharges

Form	Grade	Surcharge
TISH	6AL4V	8.80
TIPL	6AL4V	5.87
TIPL	6AL4VE	6.45
TIBR	6AL4V	6.88
TIBR	6AL4VE	4.45
TICO	GR 2	8.69
TICO	GR 3	8.69
TICO	GR 4	8.69
TISH	GR 2	8.69
TISH	GR 3	8.69
TISH	GR 4	8.69

Green Steam: Heat Recovery and Power Generation in the Clean Energy Transition

As the world's industries look to optimize their operations, with clean energy and carbon emissions targets looming ever larger in the collective consciousness, an increasing number of new, or at least reimagined, industrial applications and processes are coming to the fore as a means to this end. Often, such work can be about utilizing existing technologies better, or perhaps combining them with new technological processes and devices in more efficient, more innovative ways. One such example is the heat recovery steam generator, which captures waste heat produced in power facilities, and stores it as steam, which can later be used to produce electricity, improving the operational efficiency of overall processes. The key here is that the flexibility of the process – heat is often produced by a range of industrial processes – means many companies across a range of sectors can invest in green steam. There is plenty of scope to align new environmental priorities with sectors that are often thought of as antithetical to the green energy revolution, such as coal mining or oil drilling, a fact which makes green steam all the more attractive.

Heat recovery and utilization could prove to be big business. The global heat recovery steam generator market size could hit $1.2bn by 2026, which would grant the sector a combined annual growth rate of around 4.2%. Things are moving fast, with new technological innovation and industrial investment, especially for green energy technologies, driving change in the sector. In 2022, Mitsubishi Power received an order for an H-25 gas turbine for the Taiwanese firm Chang Chun Plastics to become the core of a new high-efficiency, natural gas-fired cogeneration facility at the company's Dafa Factory in Kaohsiung. Operation is scheduled to begin around winter 2023, with the unit supplying power for the company's factories, and steam for manufacturing processes. Chang Chun Plastics' Dafa Factory is located in an industrial park east of downtown Kaohsiung City. The gas turbine will replace the existing oil and coal-fired boiler facility, part of a project conducted in response to a request from the Kaohsiung authorities to reduce coal consumption, based on the global trend toward reducing carbon dioxide emissions, and a shift in Taiwan's energy policy. As a result, steam utilization and cogeneration projects such as these are not just the beneficiaries of technological innovation, but exist at a nexus between national interest, environmental urgency and the need for companies to continue to deliver profits for investors and shareholders.
Read the full article here.

Apex to Launch First Satellite in 2024

Small satellite manufacturer Apex will launch its first satellite next year as a demonstration of its capabilities as it prepares for large-scale production.
Apex announced April 4 that its first Aries satellite will fly on SpaceX's Transporter-10 rideshare mission, scheduled for launch no earlier than January 2024. The satellite mission, dubbed "Call to Adventure" by the company, will carry multiple payloads for a set of undisclosed customers.

The mission is principally a technology demonstration for Apex, testing the performance of the 200-kilogram Aries satellite. "We want to be able to test out certain maneuvers and do some higher risk operations once we're in space," said Ian Cinnamon, chief executive of the company, in an interview.

The customers, he said, are those interested in buying full spacecraft from Apex and have signed what he called "multimillion-dollar contracts" for the mission. "After our paying customers are done utilizing the spacecraft for their needs, we are able to use the spacecraft as an in-space testbed" and gain flight heritage on key subsystems before going into full-scale production.

Apex announced in October its plans for mass manufacturing of small satellites, raising a $7.5 million seed round. The company added funding after that announcement, Cinnamon said, increasing it to $10 million. The company currently projects producing five Aries spacecraft in 2024, increasing to 20 in 2025 and 100 in 2026.

The company's goal is to produce a standardized bus that can be built in volume and support different customers without costly customization. "The whole mentality of our company is shifting to this productized approach where we're not doing custom NRE [non-recurring engineering] for each end customer," he said. "We've designed it such that we don't have to change anything on the spacecraft if a different customer wants a different configuration package."

Apex has not disclosed customers for the Aries satellite, but Cinnamon said the company has had talks with both government and commercial customers. Commercial interest, he said, includes using those satellites for imaging and communications as well as applications related to orbital transfer vehicles. Government customers, notably in national security, are interested in satellites that can be built rapidly.

The company has plans for two larger satellites: Nova, weighing 500 kilograms, and Comet, weighing 1,000 kilograms. Half the mass of those spacecraft, as well as the smaller Aries, is devoted to payload and fuel, with the other half the bus itself. Read the full article here.

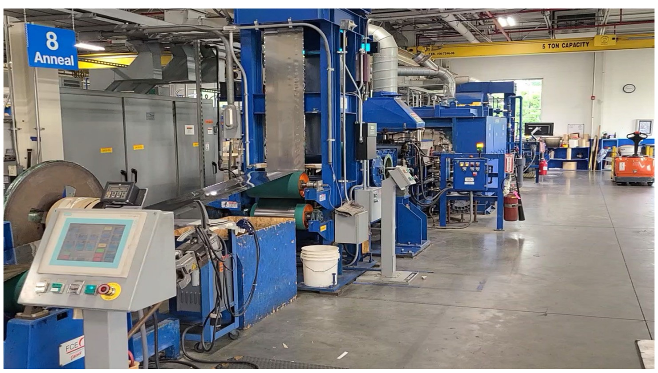
300 Parts Down to Just 7: The Benefits of General Electric's Additive Manufacturing Techniques

Thanks to additive manufacturing techniques, General Electric combined more than 300 engine parts into only seven on the GE9X engine. Additive manufacturing techniques use Computer Aided Design (CAD) software or three-dimensional object scanners to direct machines to deposit specialized material, layer upon layer, in precise geometric shapes.

Design information from the CAD software guides the path of a nozzle or print head as it deposits material into a specific form. Each successive layer bonds to the preceding layer of melted or partially melted material. The process repeats until the entire part is created. The loose or un-fused material is removed during post-processing and recycled for the next part. The additive manufacturing process differs from conventional processes, where materials are machined, milled, or carved to obtain a desired form.

The GE9X is the largest and most powerful aircraft engine in the commercial aviation market. The high-bypass turbofan, derived from the GE90, features a massive fan, advanced materials, and higher bypass and compression ratios. With the maximum capability of producing 134,300 lbf (pound-force) of thrust, it is 5% more potent than its predecessor. Despite its capability, the engine is currently rated at 110,000 lbf of takeoff thrust. Advanced materials and processes make the engine more efficient, quieter, and with fewer emissions. General Electric's GE9X is explicitly designed for Boeing's latest member of the 777 family, the Boeing 777X.

The heart of the turbofan engine is its high-pressure compressor, also known as the core. The compressor ensures incoming air gets compressed to an optimum pressure ideal for combustion. It comprises a series of compressor stages (rotary blades and stationary vanes) that gradually compress the air. In a conventional design, compressor blades on each stage are individually attached (with spacers, retainers, and bolts) to the disk or drum. A disk (or bladed disk) is made of rotor disks and blades; each rotating stage may consist of hundreds of individual parts. The first five stages of the GE9X engine's high-pressure compressor are considered blisks (combined bladed disks). A blisk consists of a single part connecting the disk and rotating blades through additive manufacturing, integral casting, or simply welding individual blades to a rotor disk. Eliminating the need to attach blades to the disk decreases the number of components in the compressor. Blisks significantly minimize drag and increase the overall efficiency of the GE9X engine by up to 8%. Moreover, the design eliminates the source of crack initiation and propagation in the blades' dovetail slots (attachments). Blisks undergo rigorous harmonic vibration testing and dynamic balancing to an extremely high standard. This is because the damping of the dovetail attachment is not present in blisks. A significant disadvantage of blisks is that any damage to the blades beyond minor dents requires complete engine removal so that the blisk may be repaired or replaced. Read the article here.



UPM Focus: UPM's Thin-Gauge Capabilities

United Performance Metals has been in the process of getting the Precision Thin Gauge facility off the ground for quite some time to offer our customers a unique product offering. We spoke with Patrick Robb, a metals industry-whiz who is heading up the project, to hear his thoughts on where the UPM Thin Gauge plant will be in the next year and where it will take the company.

Following a number of years of being employed at Ulbrich Stainless Steels & Special Metals, Patrick Robb decided to join the UPM team. He was inspired by the potential that UPM's acquisition of the Thin Gauge facility had and wanted to take on the challenge of adding new capabilities to UPM's already impressive portfolio. What attracted him even more to the company was the prospect of bringing the Thin-Gauge facility to the forefront of not only UPM, but the metals industry altogether.

"Really, it was a question to myself of what I wanted to do with the last five to seven years of my career, and the challenge of incorporating a new thin-gauge facility into UPM ultimately brought me to the company", Robb said.

Speaking on the capabilities of the Thin Gauge facility, Robb's goals for the new operation will be to "become the premier precision light-gauge producer of nickel-coil-based and stainless steel alloys of thicknesses of triple zero-eight up to 0.015. We are aiming to have the best lead times in the industry and provide unmatched service to our customers".

When asked why precision thin-gauge production will be an important aspect of UPM's growing business, Robb stated that "there are just so many markets that the material is used in, and thin gauges of the alloys that UPM already stocks can be applied to all of these markets. For example, thin gauge is used a lot in the automotive industry, specifically in the airbag systems. Thin gauge materials are especially used in the making of needles. Foil products are used everywhere, and you'd be amazed at all of the applications they have".

It's safe to say that within the coming years, Patrick Robb and the precision thin-gauge division of United Performance Metals will be an integral part of the team. Speaking on the thin-gauge team in Connecticut, Robb said that in 30 years, he has not seen a better team for rolling precision thin-gauge material than UPM's. To learn more about UPM's thin-gauge division, stay tuned to our blog page! Interested in getting a quote of thin gauge material? Fill out a quote request form here.