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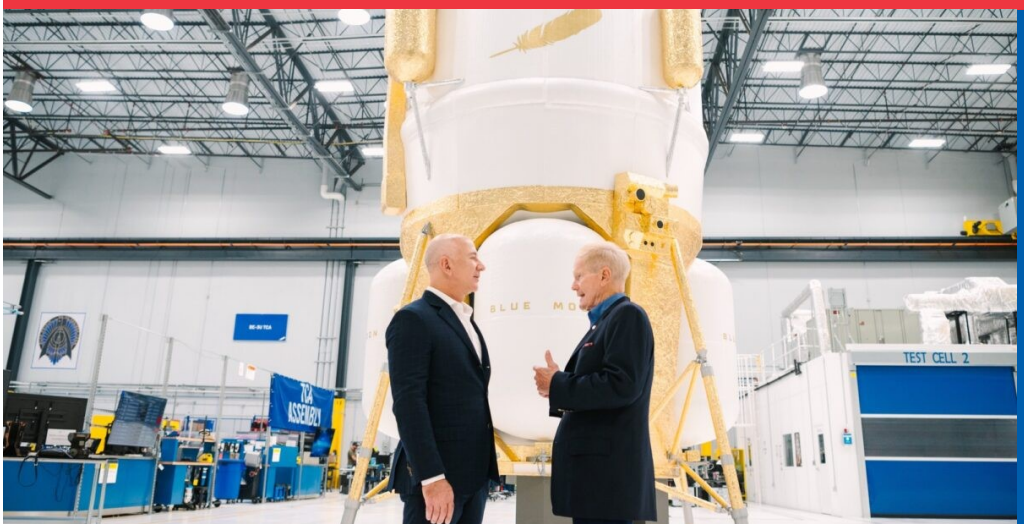

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Blue Origin Reveals Mockup of Blue Moon Lunar Lander Prototype

Blue Origin has unveiled a full-sized mockup of an uncrewed version of its Blue Moon lunar lander that will test technologies intended for a crewed version it is developing for NASA's Artemis effort.

In social media posts Oct. 27, the company showed images of the Blue Moon Mark 1 mockup, located at an engine manufacturing facility in Huntsville, Alabama. The lander is designed to deliver three tons of cargo to the lunar surface.

The first flight of Blue Moon Mark 1 will be what the company calls the "Pathfinder Mission," designated MK1-SN001. "MK1-SN001 proves out critical systems, including the BE-7 engine, cryogenic fluid power and propulsions systems, avionics, continuous downlink communications, and precision landing," the company stated on its website.

Blue Origin said that future Mark 1 landers, starting with MK-SN002, will be available to carry customer payloads. Blue Origin is one of 14 companies that are part of NASA's Commercial Lunar Payload Services program for uncrewed lunar landings. The company, though, did not state when the Pathfinder Mission or future Blue Moon Mark 1 landers might launch.

"There's two Mark 1 lunar pathfinder landers that will fly on early flights of New Glenn," Ben Cichy, senior director of engineering of lunar permanence at Blue Origin, said on a panel discussion at AIAA's ASCEND conference Oct. 23, but was not more specific about launch dates.

John Couluris, senior vice president of lunar transportation at Blue Origin, said on a panel at the American Astronautical Society's von Braun Space Exploration Symposium Oct. 25 that the Mark 1 lander was part of a continuum that includes the Mark 2 lander intended for crewed landings. NASA selected that lander as part of its Human Landing System (HLS) program in May, joining SpaceX's Starship. He noted that NASA's requirements for HLS include landing within 100 meters of a designated location. Blue Origin is developing a terrain relative navigation system using lidar, tested on New Shepard suborbital flights and then later on Mark 1 landings, to get the landing precision "down to single-digit meters," he said.

The Blue Origin announcement coincided with a social media post by NASA Administrator Bill Nelson, which showed him seeing the Blue Moon mockup with a group that included Blue Origin founder Jeff Bezos. Nelson said Blue Moon "will help ensure a steady cadence of astronauts on the Moon to live and work before we venture to Mars." Neither NASA nor Blue Origin disclosed when Nelson and Bezos visited the facility, but Nelson was in Huntsville Oct. 25 to speak at the von Braun Symposium. Read the full article here.

Nickel/Cobalt & Stainless-Steel Flat Rolled Surcharges

	Aug	Sept	Oct	Nov	Dec	Jan
15-5	0.9852	0.9940	0.9599	0.9103	*	*
17-4	0.9986	1.0078	0.9737	0.9238	*	*
17-7	1.0578	1.0640	1.0218	0.9603	*	*
201	0.7335	0.7302	0.6995	0.6713	*	*
301 7.0%	1.0324	1.0392	0.9980	0.9388	*	*
302/304/304L	1.1360	1.1438	1.0995	1.0315	*	*
304-8.5%	1.1814	1.1897	1.1438	1.0713	*	*
305	1.5061	1.5177	1.4605	1.3566	*	*
309	1.5499	1.5615	1.5050	1.4019	*	*
310	2.2118	2.2303	2.1511	1.9852	*	*
316/316L	1.7535	1.8112	1.7667	1.6247	*	*
321	1.2169	1.2227	1.1750	1.0978	*	*
347	1.5234	1.5322	1.4846	1.4074	*	*
409/409 Mod	0.3194	0.3169	0.2975	0.3001	*	*
410/410S	0.3267	0.3267	0.3074	0.3101	*	*
430	0.3830	0.3830	0.3647	0.3686	*	*
439	0.3989	0.3949	0.3770	0.3811	*	*
263	9.6772	8.9444	8.4765	8.9779	9.0827	8.7045
276	10.9707	10.7136	10.5559	10.5271	10.7552	9.8207
A286	3.3624	3.1591	2.9677	2.9181	2.8866	2.7438
600	8.3296	7.7083	7.2431	7.1216	6.9579	6.6048
601	6.8854	6.3922	5.9930	5.8958	5.7653	5.4831
617	10.0656	9.4894	9.1029	9.3428	9.4716	9.0559
625	10.8917	10.4959	10.1864	10.1222	10.2172	9.8207
718	9.4656	9.0635	8.7390	8.6605	8.6247	8.3341
X-750	8.6586	8.0609	7.6070	7.4798	7.3173	6.9845
800	3.7774	3.5221	3.2999	3.2300	3.1618	3.0082
825	5.5654	5.2746	5.0231	4.9678	4.9676	4.7352
HX	7.7294	7.4375	7.2075	7.1806	7.3057	6.9550
188	10.0419	9.0778	8.6075	9.9286	9.7249	9.3558
L-605	9.9560	8.8933	8.4040	10.0520	9.8839	9.5253

*Surcharge currently not available

Thin Gauge Stainless Steel and Nickel Alloy Surcharges

	Aug	Sept	Oct	Nov	Dec	Jan
301 7%	1.24	1.25	1.20	1.13	*	*
302/304/304L	1.36	1.37	1.32	1.24	*	*
304 8.5%	1.42	1.43	1.37	1.29	*	*
305	1.81	1.82	1.75	1.63	*	*
316L	2.10	2.17	2.12	1.95	*	*
321	1.46	1.47	1.41	1.32	*	*
347	1.52	1.53	1.48	1.41	*	*
201	12.65	11.65	10.98	10.79	10.53	9.96
600	10.00	9.25	8.69	8.55	8.35	7.93
625	13.07	12.60	12.22	12.15	12.26	11.78
625LCF	13.07	12.60	12.22	12.15	12.26	11.78
718	11.36	10.88	10.47	10.39	10.35	10.00
Alloy X	9.28	8.93	8.65	8.62	8.77	8.35
X750	10.39	9.67	9.13	8.98	8.78	8.38

*Surcharge currently not available

Nickel/Cobalt & Stainless-Steel Bar Surcharges

	June	July	Aug	Sep	Oct	Nov
316LS/316LVM	2.94	2.85	2.82	2.88	2.77	2.43
Custom 455	1.80	1.68	1.57	1.57	1.51	1.39
Custom 465	2.52	2.37	2.17	2.19	2.12	1.94
Custom 630	1.30	1.23	1.21	1.20	1.15	1.04
CCM	9.06	10.23	12.56	12.20	9.94	10.77
625	11.21	10.96	10.57	10.78	10.36	9.40
718	8.80	8.58	8.15	8.19	7.85	7.26
718CR	8.80	8.58	8.15	8.19	7.85	7.26
A286	4.50	4.25	3.98	3.99	3.84	3.52
A2861	4.50	4.25	3.98	3.99	3.84	3.52
A2862	4.50	4.25	3.98	3.99	3.84	3.52
A2867	4.50	4.25	3.98	3.99	3.84	3.52
A286R1	4.50	4.25	3.98	3.99	3.84	3.52
A286SH	4.50	4.25	3.98	3.99	3.84	3.52
Alloy X	9.16	9.01	8.65	8.86	8.50	7.66
Wasp6	10.15	10.06	10.20	10.16	9.37	8.89
L605	10.22	11.01	12.84	12.46	10.78	11.53
321	2.00	1.88	1.85	1.83	1.75	1.58
347	1.99	1.88	1.85	1.84	1.75	1.58
Greek Ascoloy	1.51	1.45	1.46	1.46	1.45	1.36

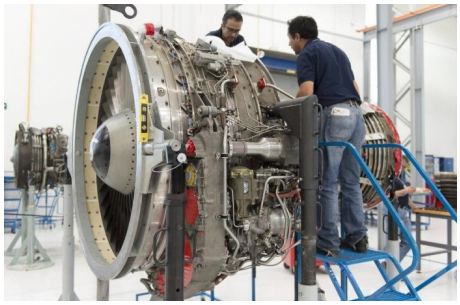
*Surcharge currently not available

Titanium Surcharges

Form	Grade	Q1 Surcharge	Q2 Surcharge	Q3 Surcharge	Q4 Surcharge
TISH	6AL4V	5.56	8.80	8.80	8.80
TIPL	6AL4V	3.71	5.87	5.87	5.87
TIPL	6AL4VE	4.08	6.45	6.45	6.45
TIBR	6AL4V	7.50	6.88	6.88	6.88
TIBR	6AL4VE	4.45	4.45	4.45	4.45
TICO	GR 2	8.33	8.69	8.69	8.69
TICO	GR 3	8.33	8.69	8.69	8.69
TICO	GR 4	8.33	8.69	8.69	8.69
TISH	GR 2	8.33	8.69	8.69	8.69
TISH	GR 3	8.33	8.69	8.69	8.69
TISH	GR 4	8.33	8.69	8.69	8.69

*Surcharge currently not available

The Rise of Mexico's Aerospace Industry



Economic activity in Mexico has rebounded since the COVID-19 pandemic, benefiting the manufacturing sector due to opportunities created by the disruption of supply chains, including in the aerospace sector.

The aerospace sector is one of the youngest industries in Mexico. It has been around for roughly 18 years and in that time it has managed to employ around 60,000 workers to date and export US 8 billion of goods in 2022, a significant advance in the recovery of this industry, which was affected by pandemic restrictions that left practically 50% of the global fleet grounded.

Mexico has been characterized as an attractive country for the development of this industry due to the quality of its workforce, but that is not all. The industry success has been such that in recent years it has attracted engineering, design, development and research projects of large global firms.

Carlos Robles, president of the Mexican Federation of the Aerospace Industry (FEMIA), a nonprofit organization that represents at a national and international level the main aerospace companies established in the country, one of the main catalysts of this industry was Bombardier, which, upon its arrival in 2006, began to develop an entire strategy around supply and talent to support its operation.

"They developed between 10 and 12 suppliers at the time, which meant that upon the arrival of another OEM [original equipment manufacturer] or Tier 1 [direct supplier for OEM] company they already found suppliers in Mexico. This was like a snowball that began to generate inertia and attracted attention to the country as a potential market for global companies due to the benefit of logistics costs and the efficiency of the Mexican workforce," Robles explained.

Along with the development of this industry, the Aeronautical University in Querétaro (UNAQ) was created and in other educational institutions in the country, from universities and technical schools, specialized engineering programs in the aerospace sector were developed.

Over time, the snowball effect translated into a greater number of companies, investment, a greater volume of production, the generation of new jobs and a position in the global market as the 12th largest exporter. The objective of FEMIA is to position Mexico within the top 10 worldwide and introduce companies to the space sector.

"The products made in Mexico are of high added value and complexity… Of the most complicated component [sic] that an airplane can have, such as turbine parts, doors —in structural terms —are in Mexico; from electronics, avionics, composite materials, machined parts and it is done with very good quality," Robles said.

This, in addition to cost reduction through efficiency, innovation in continuous process improvement, logistics costs, and the availability of qualified personnel, are the main assets that make Mexico a strong player in the market and attractive in the face of readjustment of supply chains after the pandemic. Read the article here.

China's Space Pioneer Raise Funding for its Falcon 9-Class Rocket

Chinese commercial launch firm Space Pioneer has announced a new round of funding for development of the Tianlong-3 rocket comparable to the SpaceX Falcon 9.S pace Pioneer—full name Beijing Tianbing Technology Co., Ltd—announced the "C+" funding round worth "several hundred millions yuan," Oct. 25 (100 million yuan = $13.7 million). This 12th round of funding will go towards completing the Tianlong-3 rocket which is to be capable of lifting 17 tons to low Earth orbit (LEO), according to a company press statement.

The funds will also be used for production of the smaller Tianlong-2, which had a successful inaugural flight in April this year. That launch made the company the first Chinese commercial firm to reach orbit with a liquid propellant rocket. Construction of a launch site for the Tianlong-3 at China's Jiuquan spaceport in the Gobi Desert is also noted. Space Pioneer is targeting a first Tianlong-3 launch in the first half of 2024. It aims to launch 30 times per year within three years of the debut launch.

The round was led by CITIC Construction Investment, the engineering and construction arm of Chinese state-owned CITIC Group. A number of other state-owned investment vehicles, including CICC, China Construction Bank, CITIC and Zhejiang University Lianchuang, have participated in earlier rounds. Tianlong-3 ("Sky Dragon-3") is a two-stage kerosene-liquid oxygen rocket with a reusable first stage. The 71-meter-long rocket will have a diameter of 3.8 meters. It will have a takeoff mass of 590 tons and produce 770 tons of thrust. Space Pioneer states that the rocket will be capable of lifting 17 tons of payload to low Earth orbit, or 14 tons to 500-kilometer sun-synchronous orbit. Tianlong-3 is by far the largest commercial rocket close to launch in China. It would also be nationally second only to the expendable Long March 5B (25 tons) terms of capacity to LEO.

Not only have Chinese commercial rockets made breakthroughs with Tianlong-2 and Landspace's Zhuque-2, but national-level policies and projects are now in place to provide opportunities for companies. This includes potential cargo launches to the Tiangong space station. Space Pioneer, moreover, claims that it will have the capability of carrying 30 satellites on a single launch. This, it says, meets the "low-cost, high-reliability, and high-frequency" launch requirements for China's national LEO satellite Internet project.

China is planning to construct its "Guowang" LEO communications mega constellation of 13,000 satellites. Commercial firms are apparently able to participate in the national project. Tianlong-3 could potentially provide high-density, high-capacity launch capabilities that China currently lacks. The country's main state-owned space contractor CASC has meanwhile stated it is planning to ramp up production of its expendable Long March 5B and Long March 8 rockets. Efforts include the construction of a new launch site at Wenchang to help get the Guowang project off the ground. The firm is also gearing up for its second orbital launch attempt. Jiangsu News reported Oct. 23 that the company's second Tianlong-2 rocket has been transported from Tianjin to Zhangjiagang, Suzhou. The rocket, powered by coal-derived kerosene and CASC-developed YF-102 gas generator engines, will launch in 2024. Read the full article here.

3 Technology Trends Driving Innovation in Spine

Ahead of the NASS' Annual Meeting, we highlighted multiple market drivers in spine: motion-preserving implants, enabling technologies and mergers and acquisitions. These trends were discussed in nearly every conversation we had with spine companies, surgeons and academic researchers at the Annual Meeting in Los Angeles.

Companies are highly focused on R&D efforts while keeping their operations lean and efficient in hopes of being acquired or having capital to be the acquirer. This recap highlights three technologies that speak to the overarching trends we learned about at NASS.

Motion preservation is gaining interest in spine as startups enter clinical and commercialization phases with novel technologies. Those with tenure in the spine market remember the wave of interest in motion preservation in the early 2000s that brought new artificial discs to the market. While activity has shifted in the space over the years, companies continue to work on differentiated implants and techniques.

The application of smart implants has risen in recent years as companies seek to track a patient's healing process and collect significant amounts of data that can be used to further R&D and personalized medicine efforts. Multiple spine companies have products in development.

NanoHive Medical and DirectSync Surgical recently finalized a deal to develop a stimulating/sensing 3D-printed fusion cage. The collaboration is focused on two initiatives. The first is to integrate patient-powered stimulation into NanoHive's 3D-printed implants, with the goal of expediting fusion and potentially mitigating the use of biologics. The second is to equip surgeons with a postoperative data analysis tool.

Although preoperative planning, navigation and robotics are not new in spine, they have not gained broad adoption. We continue to see new companies commercialize systems with smaller footprints and a lower price point in hopes of gaining market share and improving adoption rates. Of course, the largest spine companies are launching enhancements to technology already on the market. Stryker featured its Q Guidance System at NASS and said that it completed 2,400 spine surgeries with the technology in its first year. Read more.

UPM Focus: Waterjet FIRSTCUT+® Processing Solution

For this month's edition of the UPM Focus, we wanted to focus on one of the many FIRSTCUT+® Processing Services that UPM offers; Waterjet Cutting. United Performance Metals' waterjets are essential to many of our operations, including the beginning stage of our additive manufacturing process. Jeff Hopper, Operations Lead at our Northbrook, Illinois, facility gave us a tour and walked us through the day-to-day process at the location and the use of the waterjet machines.

Waterjet cutting utilizes extremely pressurized water mixed with a garnet to form a stream powerful enough to make precise cuts through material like stainless steel. There are two machines used in UPM's Northbrook facility that are interchangeable. One is called the "MAZAK® 4000-Watt Calypso Hammerhead Water Jet" and it is a staple of the Northbrook facility. An incredibly intense flow of the water and garnet mix is fired from this machine at high speeds, designed to erode exact lines in raw material. "Think of a waterjet as the world's sharpest tool; when we combine it with the garnet, it basically becomes a powerful stream of sandpaper that cuts precisely through whatever we load on the machines," Hopper explained. "Waterjet cutting is unique because the high-pressure water is able to cut through tough metal that can be up to three inches thick," said Bob Cimarusti, fellow Operations Lead in Northbrook.

A great feature of waterjet cutting is that it eliminates the potential of distorting the metal via intense heat, a risk that is present in laser cutting. Cimarusti said, "The reason we utilize waterjet cutting on our metals versus a laser is that the edges or 'heat affected zone' is less with the waterjet. Since the heat affected zone is less, our waterjet products are therefore less prone to burrs, burn marks, or cracks. This makes our waterjet materials popular with aerospace and medical companies who require the most precise metals in the world." The whole process can take several hours to completely cut out the required shape but is an effective way of getting the most accurate cuts possible. Different thicknesses and tolerances can be achieved with the waterjet.

The waterjet has far-reaching capabilities, and Hopper says his team is always happy to help other divisions of UPM. "A lot of what we do with our waterjet technology involves cutting out base plates for our additive facility down in Cincinnati; we're responsible for helping them get the build plates they need," he said. UPM's waterjet team also serves a plethora of industries and customers that continuously make a difference in the world. "We have become much busier over the years, and we are cutting less sheet parts (thinner and lighter) and more plate stock and heavier parts," Hopper stated. If you are interested in learning more about UPM's waterjet cutting services, please click here. If you are interested in learning more about the other FIRSTCUT+® Processing Services we provide, click here.