United Performance Metals

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The UPM Market Informer

Boeing to Modernize US Navy's F/A-18 Super Hornets

Boeing has been awarded a contract to modernize the U.S. Navy F/A-18 fleet, extending the life of existing Super Hornets from 6,000 to 9,000+ flight hours. In the early 2020s, Boeing will begin installing initial updates to the aircraft that will convert existing Block II Super Hornets to a new Block III configuration.

The Block III conversion will include enhanced network capability, longer range with conformal fuel tanks, an advanced cockpit system, signature improvements, and an enhanced communication system. The updates are expected to keep the F/A-18 in active service for decades to come.

"The initial focus of this program will extend the life of the fleet from 6,000 to 9,000 flight hours," said Mark Sears, SLM program director. "But SLM will expand to include Block II to Block III conversion, systems grooming and reset, and O-level maintenance tasks designed to deliver a more maintainable aircraft with an extended life and more capability. Each of these jets will fly another 10 to 15 years, so making them next-generation aircraft is critical."

The indefinite-delivery contract is for up to $73 million. Work begins in April on an initial lot of four aircraft at Boeing's St. Louis production center. An additional production line will be established in San Antonio, Texas, in 2019. Additional follow-on contracts could be awarded over the next 10 years. The U.S. Navy fleet consists of 568 Super Hornets.

GE Aviation Managers Teach Manufacturing in Alabama

Joseph Moore works days on the shop floor at GE Aviation's fast-growing jet engine factory – in Auburn, Alabama – then teaches his experiences at night in the classroom. He's one of several operations managers at GE's Auburn site with a teaching role during the month-long vocational training sessions at Southern Union State Community College near Auburn to prepare GE's growing roster of hourly workers.

About four sessions are held annually to handle the demand for more trained workers in the GE Auburn factory. In addition to the Southern Union instructors, the program includes Moore and his GE colleagues each leading a three-hour evening of instruction each week.

"I really enjoy the interaction," says Moore, who teaches lean manufacturing, Six Sigma quality practices, and compliance. "Being part of the training also allows us to get a good look at the people we are evaluating for positions at the plant." The close cooperation between GE Aviation, Southern Union, and the Alabama Department of Commerce is another example of GE Aviation preparing workers for the skill sets required in its new modern factories across the U.S. *Continued on Page 2 sidebar.*

Inside This Issue

Hot Off the Press

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Why is Titanium Used in Medical Devices and Implants?

Since the 1950s, titanium has been used in various medical applications by the medical industry. These include dental implants, shoulder joints, hearing aids and hip sockets. This strong and corrosion-resistant element has natural properties that make it reliable and fully biocompatible.

What is even more interesting about titanium is that it promotes osseointegration by physically bonding with the bone around which it is placed, without any need for an extra adhesive. Titanium implants can resist high energy forces without breakage, are inert to bodily environments, and last longer than many other materials.

Metallic materials have been traditionally used by humans to replace body parts and to treat fractures for more than a century. Earlier applications with aluminum, lead, gold and silver have since been abandoned because the materials were extremely weak for long-lasting uses.

Zinc, copper, nickel, iron and steel implants used between 1920 and 1950 resulted in adverse bodily reactions. Titanium initially became popular in the dental industry in the 1940s and rapidly found its way into orthopedics in the 1950s. Presently, titanium is the most sought after material for inner-body devices, internal fixation, medical instruments and prosthetics.

Titanium, in its pure form, has a low density, high strength and a high level of corrosion resistance. In addition, it is also non-toxic and non-magnetic - two properties that are specifically beneficial for use in biomedical applications.

Its elastic modulus and coefficient of thermal expansion resemble that of human bone. The most corrosive-resistant form of titanium on the medical market is pure titanium, which is often used when malleability and ductility are important. Alloys are used when strength-to-weight ratio is essential to the success of the implant. Most interestingly, titanium integrates very well to human bone and tissue.

Titanium 6AL4V and Titanium 6AL4V ELI are the most common alloys used in medical and dental implants. These are alpha-beta alloys containing about 90% titanium, 6% vanadium and 6% aluminum. They allow a high level of fracture resistance and work in harmony with the body to promote osseointegration.

Osseointegration: Titanium is Adhesive and Non-Corrosive

When an implant is inserted into the body, it is treated as an assault and the tissue surrounding it is also extremely sensitive. Moreover, titanium is completely inert because it naturally forms a protective oxide film upon exposure to oxygen. Since this metal is completely resistant to fluid and tissue corrosion, it will not be rejected by the body.

Due to its high dielectric constant, titanium bonds well with human bone. Unlike other types of biomaterials, titanium does not require adhesives to connect with tissue and bone and facilitates this process naturally - a benefit not found in any other metal. As soon as the bond is formed, a very high force is needed to break it.

Surgical instruments such as laser electrodes, dental drills and forceps usually contain titanium because it is compatible with radiation, resistant to bacteria, durable yet non-corrosive and lightweight. Neurosurgical applications include acrylic, mesh and cranial plates. Children's titanium rib cages enable expansion as the body grows.

Finally, titanium is the preferred biomaterial around the world for elbow and shoulder joint replacements as well as hip and knee replacements. Bone screws, staples, plates, staples, cables, and mesh made of titanium not only support broken bones but also aid fixation. *Source: Azom.com*

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GE Aviation Continued

GE's Auburn facility uses sophisticated equipment to machine advanced turbine airfoils and structural components for jet engines. Machine operators vying for positions are first trained at Southern Union with a curriculum developed by the Alabama Industrial Development Training (AIDT) division and by local GE plant leaders.

GE is actively involved in the training process because GE Auburn is ramping up fast. Employment reached 200 people in March and is expected to grow to 280 by year's end, according to plant manager Ricardo Acevedo.

GE Auburn produces components for the fastest-selling jet engine in commercial aviation history, the LEAP engine for CFM International, the 50/50 joint company of GE and Safran Aircraft Engines of France.

More than 14,000 LEAP engines are on back order to power three airplanes: the Airbus Industrie A320neo, Boeing 737 MAX, and China's COMAC C919.
Continued in page 3 sidebar

Baker Hughes Rig Count

AREA	COUNT	CHANGE FROM PRIOR COUNT	CHANGE FROM LAST YEAR
U.S.	990	+6	+201
CANADA	219	-54	-57
INTERNATIONAL	979	+19	+38

Oil Prices Rise on Hints of OPEC Extending Production Cuts

Oil prices continued to rise on Friday, bolstered by news that production cuts from the Organization of the Petroleum Exporting Countries (OPEC) and Russia could be extended into 2019. Crude Oil WTI Futures gained 0.58% to $64.67 a barrel by 5:37 AM ET (9:37 GMT). Brent crude futures, the benchmark for oil prices outside the U.S., rose 22 cents, or 0.32%, to $69.13 a barrel.

Saudi Arabian Energy Minister Khalid al-Falih said on Thursday that OPEC members will need to continue coordinating with Russia and other non-OPEC oil-producing countries on supply restraints in 2019 to reduce the global oil oversupply.

OPEC, of which Saudi Arabia is the de-facto leader, has been cutting crude output by 1.8 million barrels per day (bpd) to prop up oil prices. The pact began in January 2017 and is set to expire at the end of 2018, but Saudi Arabia now seems to be pushing for an extension. The price of oil has been caught between the OPEC supply cut agreement and the rise in U.S. crude production. Investors worry that the rise in U.S. crude could dampen the efforts made by OPEC to end a supply glut.

U.S. crude production climbed to a new record of 10.4 million bpd last week, putting a drag on OPEC efforts to control supply. The U.S. has already surpassed Saudi Arabia in production and is expected to overtake Russia as the top producer by late 2018, with output of more than 11 million bpd. Meanwhile investors are looking ahead to the U.S. Baker Hughes oil rig count, which is a leading indicator of oil production and demand for oil products. The count, which comes out at 2:00 PM ET (18:00 GMT), will give investors insight into U.S. oil production, as the number of oil rigs operating in the U.S. have increased over the last few months.

In other energy trading, gasoline futures rose 0.40% at $2.0165 a gallon, while heating oil increased 0.30% to $1.9954 a gallon. Natural gas futures slipped 0.27% to $2.613 per million British thermal units. *Source: Investing.com:*

GE Aviation Continued

The Airbus and Boeing airplanes are now in airline service. The GE and Safran factories delivered 459 LEAP engines in 2017. The LEAP delivery goal for 2018 is up to 1,200 engines, and in the 1,800-engine range in 2019.

In addition to machining parts, the Auburn site this year will produce more than 34,000 fuel nozzle injectors for the LEAP engine using laser-powder, additive manufacturing machines. Auburn's 37 additive machines section is expected to grow to 45 by mid-year to handle the needed higher volume.

These employees require six weeks of in-house training. GE is looking at ways to engage the local community colleges in offering additive manufacturing as part of their curriculum. GE Aviation is also engaging with engineering students at Auburn University in additive manufacturing projects.

Training for GE's Auburn employees is not limited to community college classes. The plant also offers training in non-destructive testing where employees become certified to evaluate jet engine components scanned in advanced X-ray machines.

Among the factors attributed to high retention at the plant is the GE investment in training. During the past decade, GE Aviation has opened eight new facilities in the United States, including the new factory in Auburn. Other locations include Asheville, North Carolina; Lafayette, Indiana; and Huntsville, Alabama. In the past seven years, GE Aviation has invested more than $4.5 billion in its U.S. manufacturing operations. *Source: Aerospace Manufacturing and Design*

GE9X Engine Takes First Flight

The GE9X engine lifted off on March 13 under the wing of GE Aviation's 747 flying testbed in Victorville, California for its first flight test.

The engine that will power Boeing's new 777X aircraft took to the air around 10:40 a.m. Pacific Standard Time and flew for more than four hours on its first flight. During the flight, the aircraft and engine completed the entire test card and validated key operational and functional characteristics enabling the test campaign to progress in subsequent flights.

"The GE9X and Victorville teams have spent months preparing for flight testing of the engine, and their efforts paid off today with a picture-perfect first flight," said Ted Ingling, general manager of the GE9X program at GE Aviation. "Today's flight starts the beginning of the GE9X flight test campaign that will last for several months, allowing us to accumulate data on how the engine performs at altitude and during various phases of flight."

Certification testing of the GE9X engine began in May 2017. Beyond flight testing, the engine recently completed icing tests at GE Aviation's facility in Winnipeg, Manitoba, Canada, and continues crosswind testing at the Peebles Test Operation in Ohio. Engine certification is expected in 2019.

With almost 700 GE9X engines on order, the GE9X engine will be in the 100,000 lb. thrust class and will have a front fan 134" in diameter with a composite fan case and 16 fourth-generation carbon fiber composite fan blades. Other key features include: a next-generation 27:1 pressure-ratio 11-stage high-pressure compressor; a third-generation TAPS III combustor for high efficiency and low emissions; and CMC material in the combustor and turbine. *Source: Aerospace Manufacturing and Design*

UNITED PERFORMANCE METALS
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Surcharge Totals
January 2018—June 2018

Grades	Jan	Feb	Mar	Apr	May	Jun
15-5	0.4524	0.4861	0.5036	0.5662	*	*
15-7	0.5998	0.6970	0.7596	0.8407	*	*
17-4	0.4513	0.4829	0.4973	0.5622	*	*
17-7	0.5101	0.5609	0.6002	0.6745	*	*
201	0.4336	0.4665	0.4927	0.5632	*	*
301 7.0%	0.5054	0.5551	0.5932	0.6683	*	*
302/304/304L	0.5511	0.6066	0.6502	0.7290	*	*
304-8.5%	0.5694	0.6280	0.6744	0.7535	*	*
305	0.7022	0.7820	0.8474	0.9309	*	*
309	0.7336	0.8131	0.8758	0.9722	*	*
310	1.0080	1.1297	1.2333	1.3389	*	*
316/316L	0.7460	0.8643	0.9460	1.0358	*	*
316LS/316LVM	1.0500	1.2700	*	*	*	*
317L	0.8705	1.0197	1.1205	1.2244	*	*
321	0.5784	0.6401	0.6892	0.7660	*	*
347	0.8881	0.9497	0.9988	1.0756	*	*
409/409 Mod	0.1925	0.2003	0.2003	0.2512	*	*
410/410S	0.1995	0.2072	0.2072	0.2604	*	*
430	0.2399	0.2473	0.2473	0.3133	*	*
434	0.2923	0.3185	0.3287	0.4004	*	*
439	0.2485	0.2557	0.2557	0.3247	*	*
440A	0.2399	0.2473	0.2473	0.3133	*	*
2205	0.7020	0.8158	0.8859	0.9965	*	*
263	7.3977	7.4595	7.8741	8.7194	9.5493	10.2029
276	4.0000	4.1660	4.4784	4.4253	5.2620	5.6690
A286	1.1153	1.1137	1.2366	1.1441	1.3667	1.5171
330	1.3875	1.3971	1.5744	1.4251	1.7052	1.8860
400	2.5286	2.5921	2.9235	2.7200	3.2672	3.5440
455	0.6300	0.7200	*	*	*	*
465	0.7400	0.8800	*	*	*	*
600	2.6449	2.6794	3.0531	2.7863	3.3635	3.6864
601	2.3569	2.3837	2.6895	2.4443	2.9180	3.1917
617	5.7249	5.7558	6.1427	6.5170	7.3342	7.8691
625	4.5371	4.5376	5.0202	4.8678	5.5352	5.8802
718	4.4623	4.4733	5.0118	4.8374	5.3154	5.5832
X-750	3.1960	3.2293	3.6314	3.3689	3.9301	4.2455
825	1.8948	1.8995	2.0984	1.9619	2.3473	2.5689
HX	2.7158	2.7218	2.9709	2.8885	3.4680	3.7769
188	15.9200	17.2000	*	*	*	*
CCM	27.7100	30.0800	*	*	*	*
L-605	19.5400	21.0400	*	*	*	*

*Surcharge currently not available